



**UNITED STATES ENVIRONMENTAL
PROTECTION AGENCY
REGION 4
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET, S.W.
ATLANTA, GEORGIA 30303-8960**

July 13, 2023

Stephen Havlik
BASF Corporation
227 Oak Ridge Parkway
Toms River, New Jersey 08755

SUBJECT: Ciba-Geigy Superfund Site (McIntosh, Alabama) Operable Units 01, 02, 04
(OU1, OU2, and OU4) Groundwater

Dear Mr. Havlik:

The U.S. Environmental Protection Agency (EPA), in consultation with the Alabama Department of Environmental Management (ADEM), completed the Optimization Review Report in 2020 and the Fifth Five-Year Review for the site in 2021. BASF has submitted the 2021 Comprehensive Annual Report: Groundwater Monitoring and Corrective Action/Corrective Measures. This letter hereby notifies BASF that EPA and ADEM disapprove of the progress being made to address groundwater contamination and restore the aquifer to its beneficial use since selection of the presumptive remedy in the 1989 OU1 Record of Decision (ROD) "No Further Action" for the alluvial aquifer groundwater. Because the 1985 RCRA Part B permit issued to the site included a corrective action plan to remove and treat contaminated groundwater and surface water at the site, the 1989 OU1 ROD Declaration listed presumptive conditions that would be fulfilled by the OU1 Remedy in the Statutory Determinations, as stated below.

1. The selected remedy is protective of human health and the environment, attains federal and state requirements that are applicable or relevant and appropriate (i.e., ARARs), and is cost-effective.
2. This remedy satisfies the preference for treatment that reduces toxicity, mobility, or volume as a principal element.
3. Because this remedy will not result in hazardous substances remaining on-site above health-based levels, the five-year review will not apply to this action.

The OU1 extraction well system has been in operation since 1987 and the OU2 and OU4 soil remedies were both completed by 1997. The extraction well system has been consistently operated and improved over the years. However, the system is not making meaningful

progress toward compliance with the groundwater ARARs including the Maximum Contaminant Levels (MCLs) and/or Protection Standards (GWPSs). As a result, EPA and ADEM have concluded the OU1 remedy is not performing in accordance with the Statutory Determinations listed in the OU1 1989 ROD.

1. The OU1 remedy is failing to achieve ARARs.
2. The OU1 remedy is not reducing the toxicity, mobility, or volume of contaminants in groundwater.
3. Hazardous substances remain in groundwater above health-based levels.

The basis for EPA and ADEM's disapproval and conclusions includes evidence that groundwater contaminants of concern (COCs) are persisting at concentrations above the current MCLs/GWPSs. Groundwater monitoring wells and extraction wells have COC concentrations that are statistically stable or increasing over time. This condition implies that COC mass addition to the groundwater plume could be occurring at rates that are unacceptable to the source control objectives.

As stated in the 1991 OU2 ROD and the 1992 OU4 ROD, health-based soil cleanup levels were calculated using groundwater models, to assure that drinking water MCLs, as established under the Safe Drinking Water Act or health-based levels would not be exceeded in the groundwater because of contaminants leaching through the soil. The OU2 ROD concluded that the OU2 waste management areas are the major contributors to the contaminated groundwater and the current groundwater data show that this condition persists. The OU4 ROD concluded that the OU4 waste management area is a contributor to contaminated groundwater and the current groundwater data show that this condition persists.

EPA's 2020 Optimization Review Report included statistical trend analyses using the Mann-Kendall non-parametric test using groundwater data from January 2021 to January 2017. Results were reported for five chemicals of concern (COCs). EPA has now completed additional statistical evaluations for COCs in groundwater and concluded that the OU1 remedy is not making satisfactory progress in a reasonable timeframe toward achieving the MCLs/GWPSs. Table 1 summarizes the statistical evaluation results.

The groundwater data included in the evaluation dated from the completion of the OU2 and OU4 remedies through July 2022. This date range was selected to best represent the OU1 remedy performance since inception. EPA identified ten COCs in alluvial aquifer groundwater that exceeded the MCLs/GWPSs in one or more of the last three semiannual monitoring events and have enough COC detections to support statistical evaluation. Two COCs were identified in the upper Miocene aquifer. Wells having the COC exceedances and trend plots are listed in Table 1. The statistical methodology and representative data plots are in Attachment 1.

In addition to the statistical analyses, EPA prepared maps of the potential COC distributions in groundwater for the alluvial aquifer and the upper Miocene aquifer for the COCs exceeding the MCLs/GWPSs from 2020-2022. The distribution maps and preparation methods are in Attachment 2. The distribution plots in Attachment 2 are not intended to represent location-specific COC concentrations but should be considered in envisioning the potential magnitude of the MCL/GWPS exceedances and show data gaps that should be filled.

Groundwater monitoring wells having COC concentrations that are statistically stable or increasing over time and exceed the MCLs/GWPSs are conclusive evidence of ongoing COC mass addition to groundwater. This implies that active sources are continuing to release COCs at rates that are unacceptable and prevent achieving the groundwater remedy objectives. Thus, the EPA and ADEM are instructing BASF to take the following actions in response these conditions.

First, the EPA and ADEM request that BASF develop and implement detailed characterization plans for potential source areas to specifically identify the sources of COC addition to groundwater. The alluvial aquifer source areas to be addressed include OU2, OU4, the manufacturing area. Second, the source(s) for contamination and transport mechanisms to the upper Miocene aquifer are to be identified. Third, the delineation of contaminants in groundwater needs to be completed to the west and north of OU2 and to the east/southeast of OU4. EPA has developed a list of target contaminants to be reported for the laboratory analyses described above. The Investigation Target List is shown in Table 2. This list includes all contaminants identified in the OU1 ROD with cleanup goals plus contaminants requiring semiannual monitoring under the RCRA Corrective Action permit.

The characterization techniques should consider the approach recently proposed for the MW-3B Work Plan (LimnoTech, November 22, 2022). EPA and ADEM consider this general approach to be potentially effective approach for this work.

Ciba OU1 Source Characterization Schedule	
Submit Draft SAP/QAPP	60 days from receipt of this EPA letter
Submit Final SAP/QAPP	60 days from receiving EPA/ADEM SAP/QAPP comments
Field Mobilization	30 days from EPA approval of QAPP/SAP (in consultation with ADEM)
Draft Source Characterization Report	120 days from final sample collection

Assuming that COC sources are identified, this work will progress to improving the source control measures or implementing alternative remedies, as appropriate.

Sincerely,

A handwritten signature in black ink that reads "Beth Walden". The signature is written in a cursive, flowing style.

Beth Walden
Project Manager
Superfund & Emergency Management Division

cc:

Rhelyn Finch, EPA – finch.rhelyn@epa.gov

Ben King, ADEM – ben.king@adem.alabama.gov

Alluvial Aquifer										
Well	Bz	C-Tet	CBz	DDT	DDD	DDE	a-BHC	b-BHC	d-BHC	g-BHC
CA-4A	I	---	I	---	---	---	---	---	---	---
M-3	---	---	---	---	---	---	S	I	S	---
M-4	---	---	---	---	---	---	S	S	NC	---
M-6	---	---	---	---	---	---	NC	---	---	---
MW-10A	---	---	---	---	---	---	D	NC	NC	---
MW-9A	---	---	---	---	---	---	NC	S	NC	---
OW-2	---	---	---	S	D	S	---	---	---	---
OW-4	---	D	---	---	---	---	S	I	I	S
OW-6	---	---	---	---	---	---	I	I	S	---
PW-1	---	---	---	---	---	---	S	D	---	---
PW-2	---	---	---	NC	NC	NC	S	I	D	---
PW-3	---	I	---	---	---	---	S	S	S	---
PW-6	---	D	---	---	---	---	S	S	I	---
PW-7	S	S	S	S	I	S	S	---	S	---
PW-8	S	S	---	---	---	---	S	---	S	---

Upper Miocene Aquifer										
Well	Bz	C-Tet	CBz	DDT	DDD	DDE	a-BHC	b-BHC	d-BHC	d-BHC
MD-11	---	---	I	---	---	---	---	---	---	---
MD-12	S	---	I	---	---	---	---	---	---	---
MD-2	S	---	I	---	---	---	---	---	---	---
MD-3B	---	---	I	---	---	---	---	---	---	---
MD-7	---	---	S	---	---	---	---	---	---	---

GWPS - Groundwater Protection Standard MCL - Federal Maximum Contaminant Level

1 - Exceedances based on data from 2020-2022

Below GPS

Exceeds MCL or GWPS ¹			
<50% detects	Decreasing	Stable	Increasing
NC	D	S	I

Trends in bold font have accompanying plots in Attachment 1

Bz - Benzene
C-Tet - Carbon Tetrachloride
CBz - Chlorobenzene

DDT - 4,4'-DDD (p,p'-DDD)
DDT - 4,4'-DDE (p,p'-DDE)
DDT - 4,4'-DDT (p,p'-DDT)

a-BHC - alpha-Hexachlorocyclohexane
b-BHC - beta-Hexachlorocyclohexane
d-BHC - delta-Hexachlorocyclohexane
g-BHC - gamma-Hexachlorocyclohexane

Table 1: Summary Statistics

Ciba-Geigy Corp (McIntosh Plant)
McIntosh, Alabama

Contaminant	Analytical Class	MCL	ROD	GWPS	Units
Benzene	VOC	5	5	5	µg/L
Carbon tetrachloride	VOC	5	5	5	µg/L
Chlorobenzene	VOC	100	5	100	µg/L
Chloroform	VOC	80	5	80	µg/L
Dichlorobenzene, 1,2-	VOC	600	No	600	µg/L
Dichlorobenzene, 1,4-	VOC	75	No	75	µg/L
Dichloroethene, 1,1-	VOC	7	No	7	µg/L
Toluene	VOC	1,000	2,000	No	µg/L
Trichlorobenzene, 1,2,4-	VOC	70	No	1.2	µg/L
Vinyl chloride	VOC	2	No	2	µg/L
Chlorophenol, 2-	SVOC	--	No	9.1	µg/L
Diphenylhydrazine, 1,2-	SVOC	--	No	84	ng/L
Naphthalene	SVOC	--	10	0.62	µg/L
Nitrobenzene	SVOC	--	No	0.34	µg/L
4,4'-DDD	Organochlorine Pest.	--	No	280	ng/L
4,4'-DDE	Organochlorine Pest.	--	No	200	ng/L
4,4'-DDT	Organochlorine Pest.	--	No	200	ng/L
2,4'-DDD	Organochlorine Pest.	--	No	No	ng/L
2,4'-DDE	Organochlorine Pest.	--	No	No	ng/L
2,4'-DDT	Organochlorine Pest.	--	No	No	ng/L
Aldrin	Organochlorine Pest.	--	No	0.92	ng/L
alpha-BHC	Organochlorine Pest.	--	50	11	ng/L
beta-BHC	Organochlorine Pest.	--	No	37	ng/L
Chlorobenzilate	Organochlorine Pest.	--	No	250	ng/L
delta-BHC	Organochlorine Pest.	--	No	MDL	ng/L
Dieldrin	Organochlorine Pest.	--	No	1.8	ng/L
gamma-BHC (Lindane)	Organochlorine Pest.	200	200	200	ng/L
Arsenic	Metals	10	50	10	µg/L
Cadmium	Metals	5	No	5	µg/L
Lead	Metals	15	No	15	µg/L
Vanadium	Metals	--	No	3.6	µg/L

GWPS - Groundwater Protection Standard

MCL - Federal Maximum Contaminant Level

ROD - Record of Decision

SVOC - Semivolatile organic compound

VOC - Volatile organic compound

-- No MCL Established

Table 2: Investigation Target Contaminants

Ciba-Geigy Corp (McIntosh Plant)

McIntosh, Alabama

Attachment 1

Mann-Kendall / Theil-Sen

Groundwater Statistics

The Mann-Kendall and Theil-Sen methods are non-parametric statistical methods for regression analyses and can be used to assess time trends for environmental data. These methods are described by the U.S. Environmental Protection Agency (EPA) in Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (EPA 2009).

Mann-Kendall Statistic (S)

To calculate the Mann-Kendall statistic (S), each time-based measurement is compared to the others to produce data pairs and the data pairs are individually scored as follows:

- If the earlier data value is less than the later data value a score of 1 is assigned
- If the earlier data value is more than the later data value a score of -1 is assigned
- If the earlier and later data values are equal a score of 0 is assigned
- S is calculated as the sum of the scores and interpreted as follows
 - A positive S indicates an increasing trend
 - A negative S indicates a decreasing trend
 - Small S values near 0 can indicate a stable trend but the method does not calculate a metric to establish a stable trend

The S value is not indicative of the line slope magnitude and does not allow a determination as to the rate of decrease or rate of increase in data values over time. The Theil-Sen method described below can be used to estimate a quantified slope and provide an additional line of evidence as to whether an increasing or decreasing trend exists.

Theil-Sen Slope

The Theil-Sen method is like the Mann-Kendall S calculation in that it evaluates all possible data pairs. However, the Theil-Sen method determines the simple two-point slope magnitude for each data pair to develop the overall trend direction and slope magnitude. Rather than averaging the data-pair slopes, the median slope value is used, and using the median rather than the average makes the Theil-Sen slope non-parametric. Selecting the median value also minimizes the undesirable effects from extraneous slope measurements from data outliers and errors. The Theil-Sen trend line is constructed by combining the median slope with the median concentration and median date resulting in the Theil-Sen plot

representing the median concentration changes over time rather than the average that is estimated by a linear regression.

Theil-Sen p Value

The Theil-Sen p value is a measure of the probability of the trend slope being zero, meaning the time-based data values are stable. The numerical p values range from zero to one. A high p value indicates that the probability of the trend slope being zero is high. Low p values indicate a high probability that the calculated slope direction is valid. The metrics used for the p values are summarized below.

Theil-Sen p Metrics:

- <0.1 VALID: high probability that the trend is valid, 90 percent or greater
- 0.1 - 0.2 LIKELY VALID: moderate probability that the trend is valid, 90-80 percent
- 0.2 - 0.75 LIKEY STABLE: low probability that the trend is valid, 25-80 percent
- or
- 0.2 - 0.75 STABLE: if Theil-Sen and Man-Kendall slope directions disagree
- >0.75 STABLE: very low probability that the trend is valid, less than 25 percent

Data plots can have a high probability of an increasing or a decreasing trend according to the statistical calculations, but the rate of increase or decrease can be so low that the changes over time are essentially ineffectual and the trend should be considered stable for all practical purposes.

Kendall Tau-b

Kendall Tau-b is Kendall S divided by the total number of data pairs. The Kendall tau-b values range from 0 to 1. A greater magnitude Kendall tau-b value represents a better fit between the actual data and the regression results. Lower magnitude Kendall tau-b values do not necessarily indicate that the time-trend slope and p values are invalid, but rather the regression results may not be meaningful for predicting future results. Experience shows that environmental data rarely present trends that are useful for making accurate future predictions but can be useful for semiquantitative purposes. The Kendal Tau-b metric are listed below.

Kendall Tau-b Metrics:

- >0.65 Slope possibly meaningful for making future projections
- <0.65 Slope not meaningful for making future projections

Data Handling

Eight data points at a minimum are recommended by EPA to support the statistical analyses. For non-detect results, the method detection limit was used and, if not available, the reporting limit was used at the reported values. Estimated concentrations reported with a “J” flag were also used the reported values.

Summary

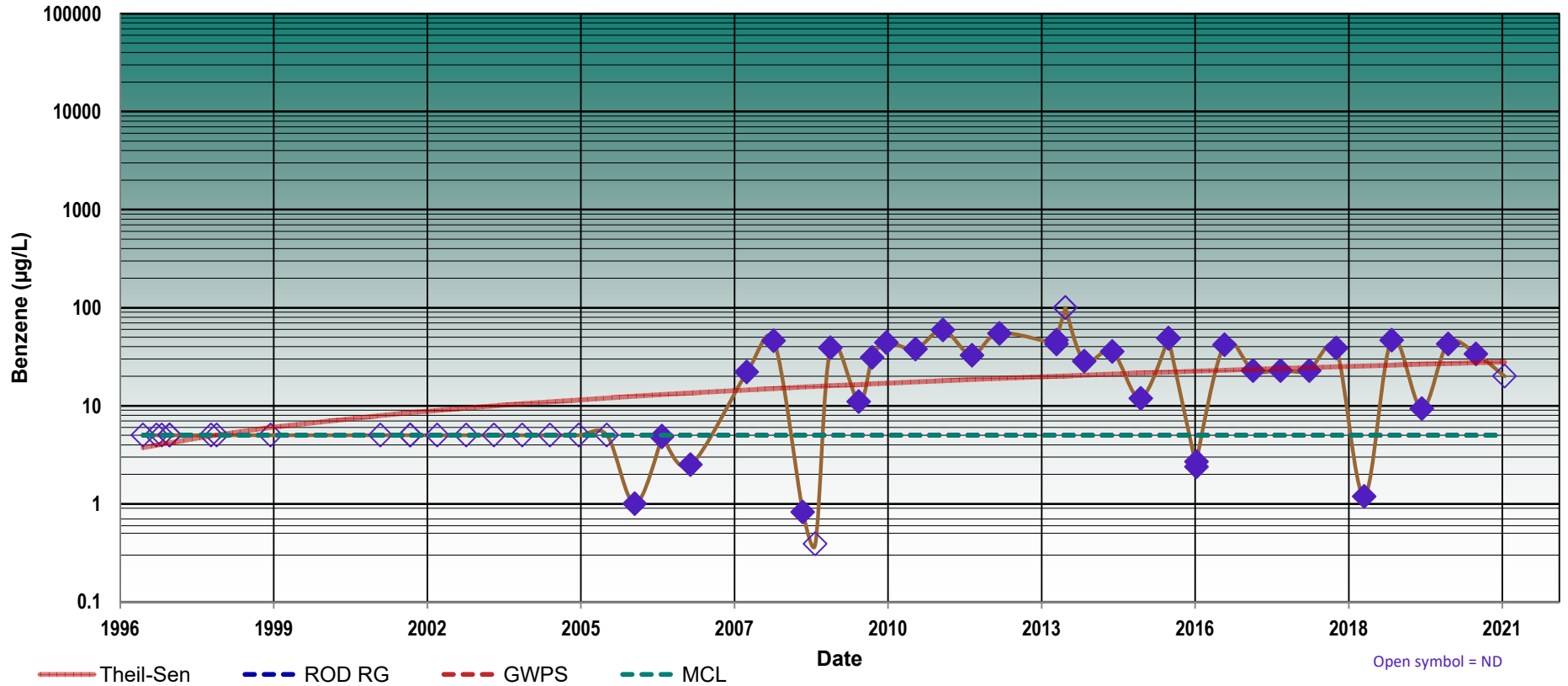
The metrics assigned to the statistics described above are based on professional judgement and strict rules dictating the statistic metrics have not been established. While the data analysis methods described above are highly quantitative and reliably produce consistent and comparable computational results, non-statistical professional judgement must be used, as is the case for most statistical methods. This can be accomplished through visual inspections of the data plots in comparison to the numerical results.

References

EPA. March 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. EPA 530/R-09-007. Office of Resource Conservation and Recovery.

Alluvial Aquifer Plots

Alluvial Aquifer: CA-4A: Benzene, µg/L

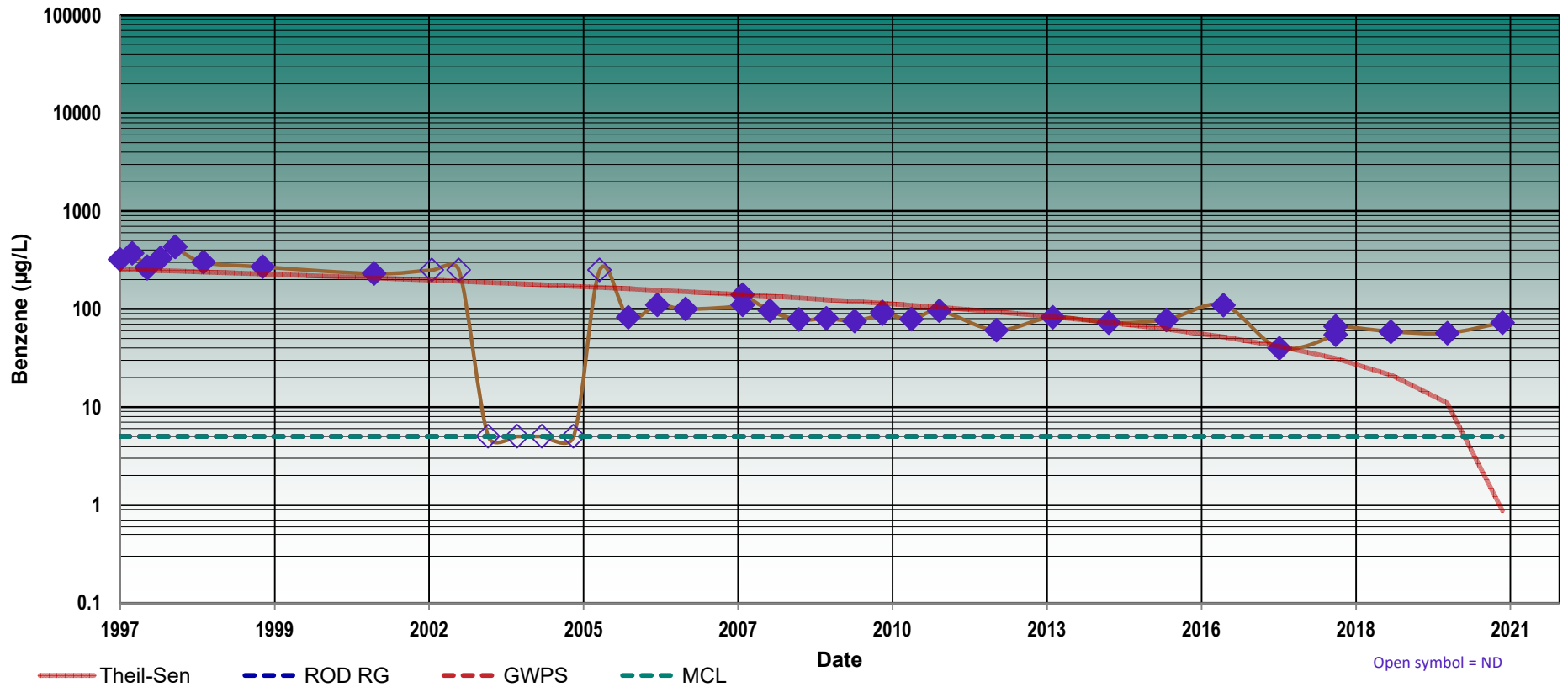


No. Data Pairs = 1540		Theil-Sen Slope = 0.00274 µg/L/day		Kendall S = 434		p-Value = 0.0018		Kendall Tau-b = 0.298			
	Most Recent Result (µg/L):		Not Detected		Most Recent Date:		7/27/21		Average (µg/L): 22		
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below								Benzene, µg/L		
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)								GWPS	ROD RG	MCL
									5	5	5
									OK	OK	OK

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-7: Benzene, µg/L

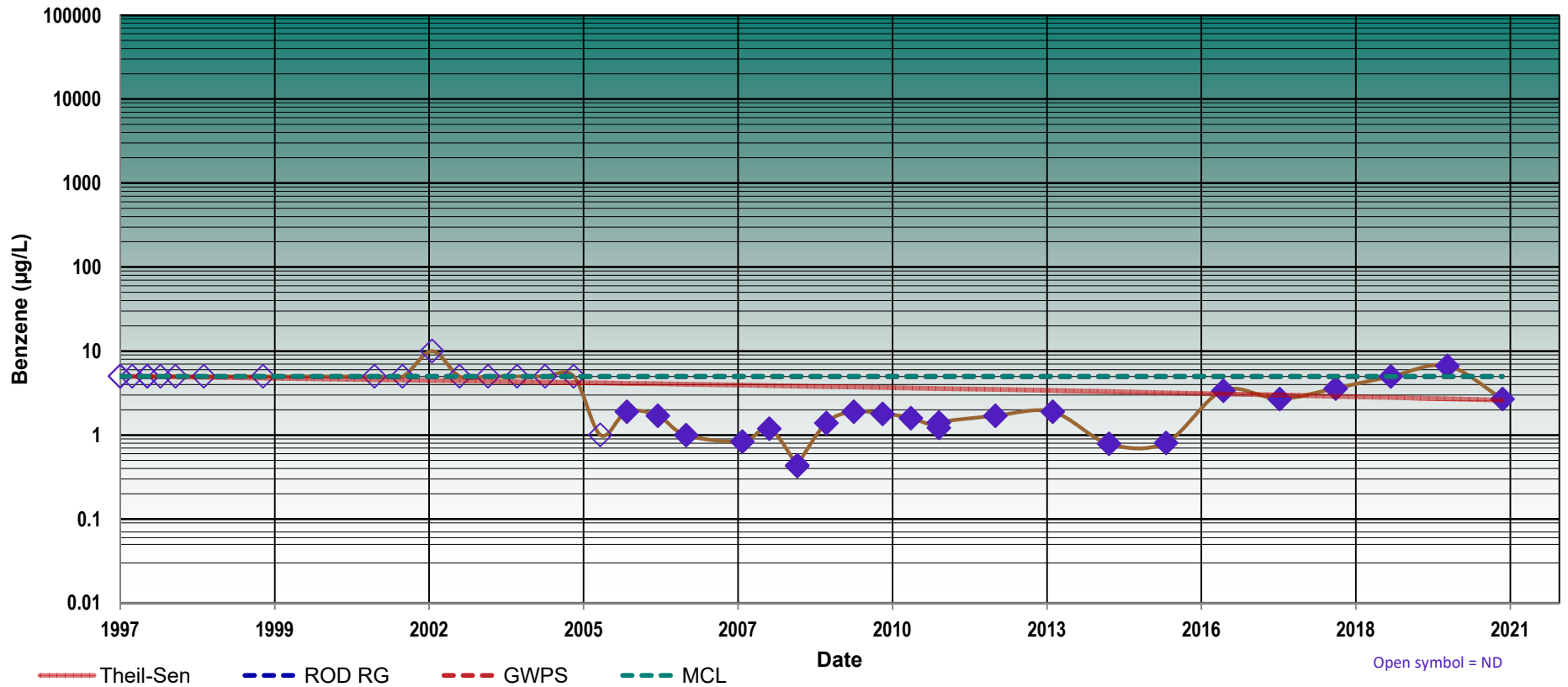


No. Data Pairs = 820	Theil-Sen Slope = -0.02829 µg/L/day	Kendall S = -434	p-Value = 0	Kendall Tau-b = 0.536		
	Most Recent Result (µg/L): 73	Most Recent Date: 7/15/21		Average (µg/L): 145		
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below			Benzene, µg/L		
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)			GWPS	ROD RG	MCL
				5	5	5
	STABLE FOR ALL PRACTICAL PURPOSES			Exceeds	Exceeds	Exceeds
	Slope insufficient to achieve the GPS in a reasonable timeframe					

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

Mann-Kendall / Theil-Sen
Groundwater Trend Analysis
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-8: Benzene, µg/L

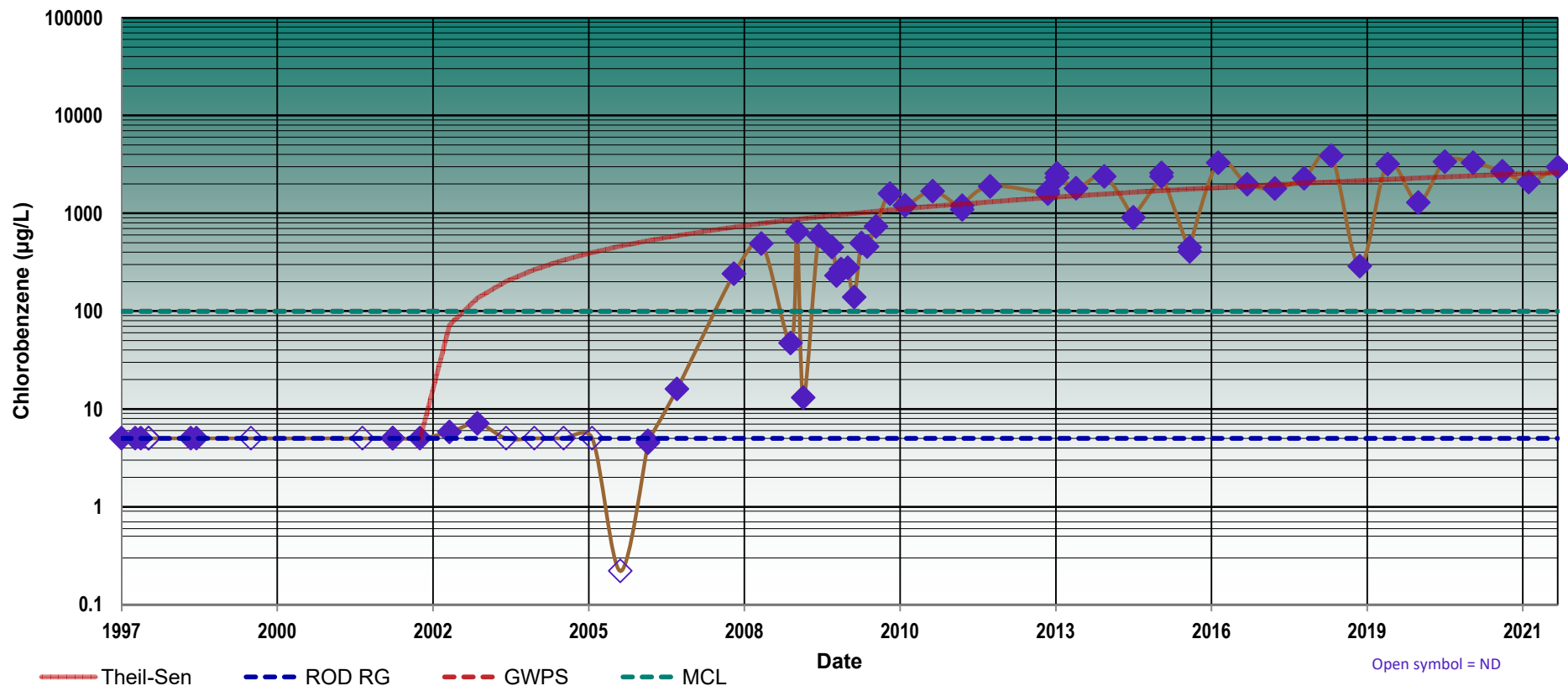


No. Data Pairs = 820		Theil-Sen Slope = -0.00027 µg/L/day		Kendall S = -238		p-Value = 0.0056		Kendall Tau-b = 0.32	
	Most Recent Result (µg/L): 2.7		Most Recent Date: 7/15/21			Average (µg/L): 3			
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below					Benzene, µg/L			
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)					GWPS	ROD RG	MCL	
						5	5	5	
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe					OK	OK	OK	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: CA-4A: Chlorobenzene, µg/L

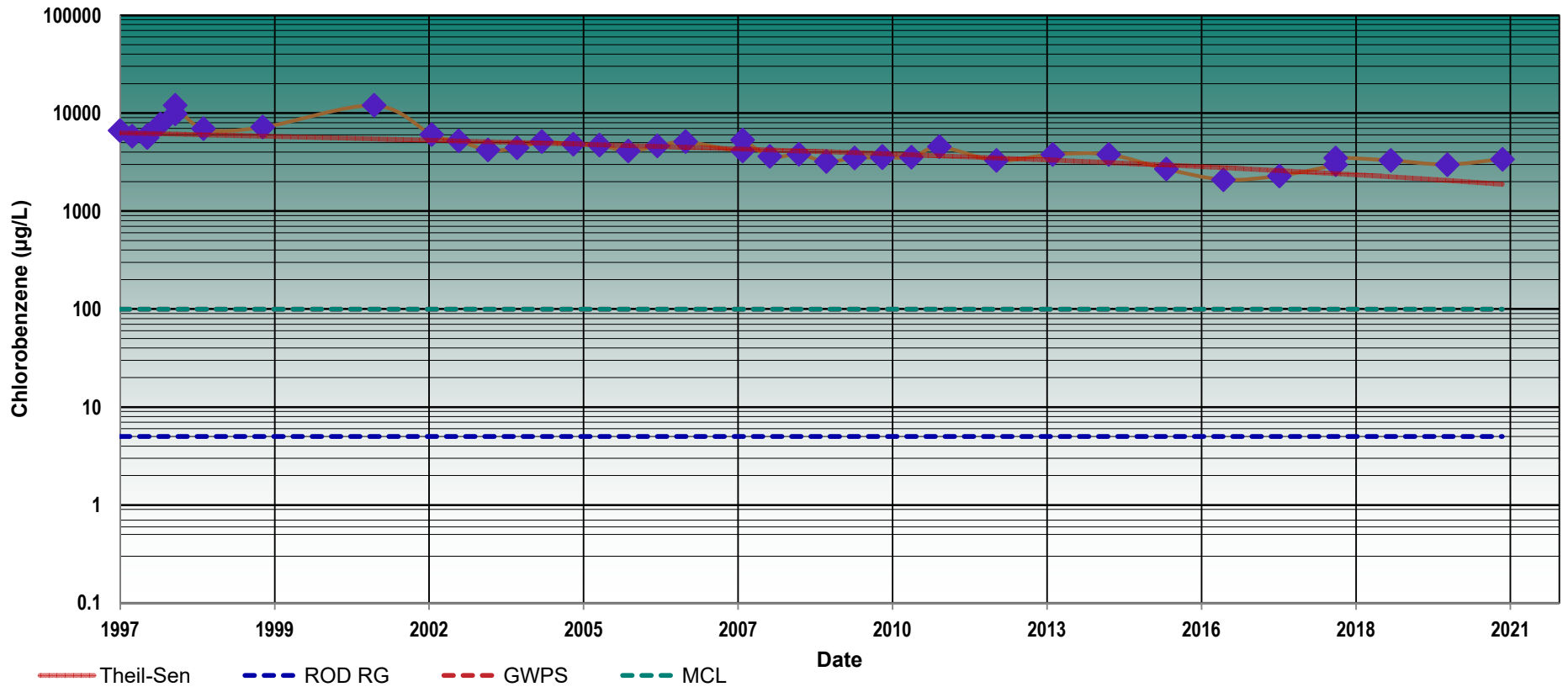


No. Data Pairs = 2346		Theil-Sen Slope = 0.35668 µg/L/day		Kendall S = 1604		p-Value = 0		Kendall Tau-b = 0.704	
	Most Recent Result (µg/L): 3000		Most Recent Date: 7/19/22		Average (µg/L): 1036				
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below					Chlorobenzene, µg/L			
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)					GWPS	ROD RG	MCL	
						100	5	100	
						Exceeds	Exceeds	Exceeds	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-7: Chlorobenzene, µg/L

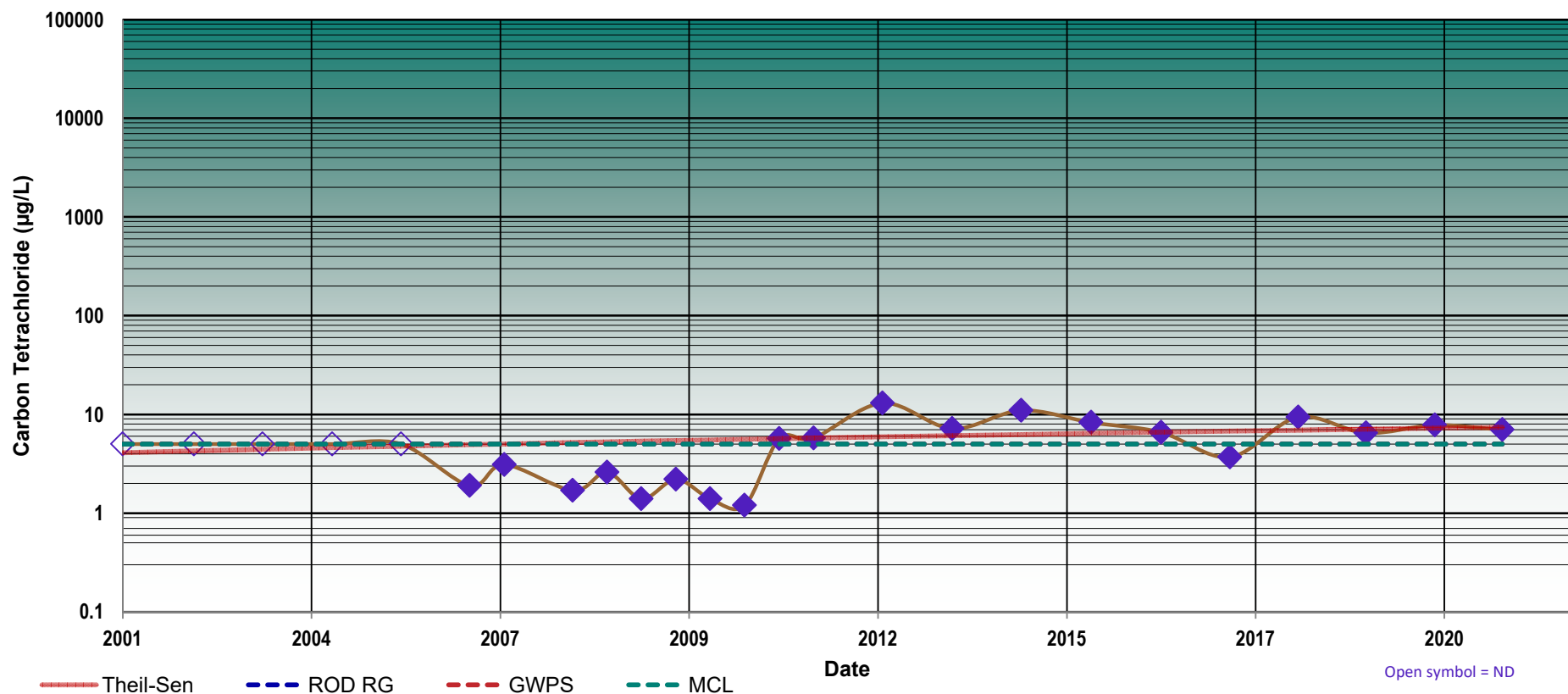


No. Data Pairs = 820		Theil-Sen Slope = -0.4912 µg/L/day		Kendall S = -565		p-Value = 0		Kendall Tau-b = 0.696			
	Most Recent Result (µg/L): 3400			Most Recent Date: 7/15/21		Average (µg/L): 4892					
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below					Chlorobenzene, µg/L					
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)					GWPS		ROD RG		MCL	
						100		5		100	
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe					Exceeds		Exceeds		Exceeds	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-3: Carbon Tetrachloride, µg/L

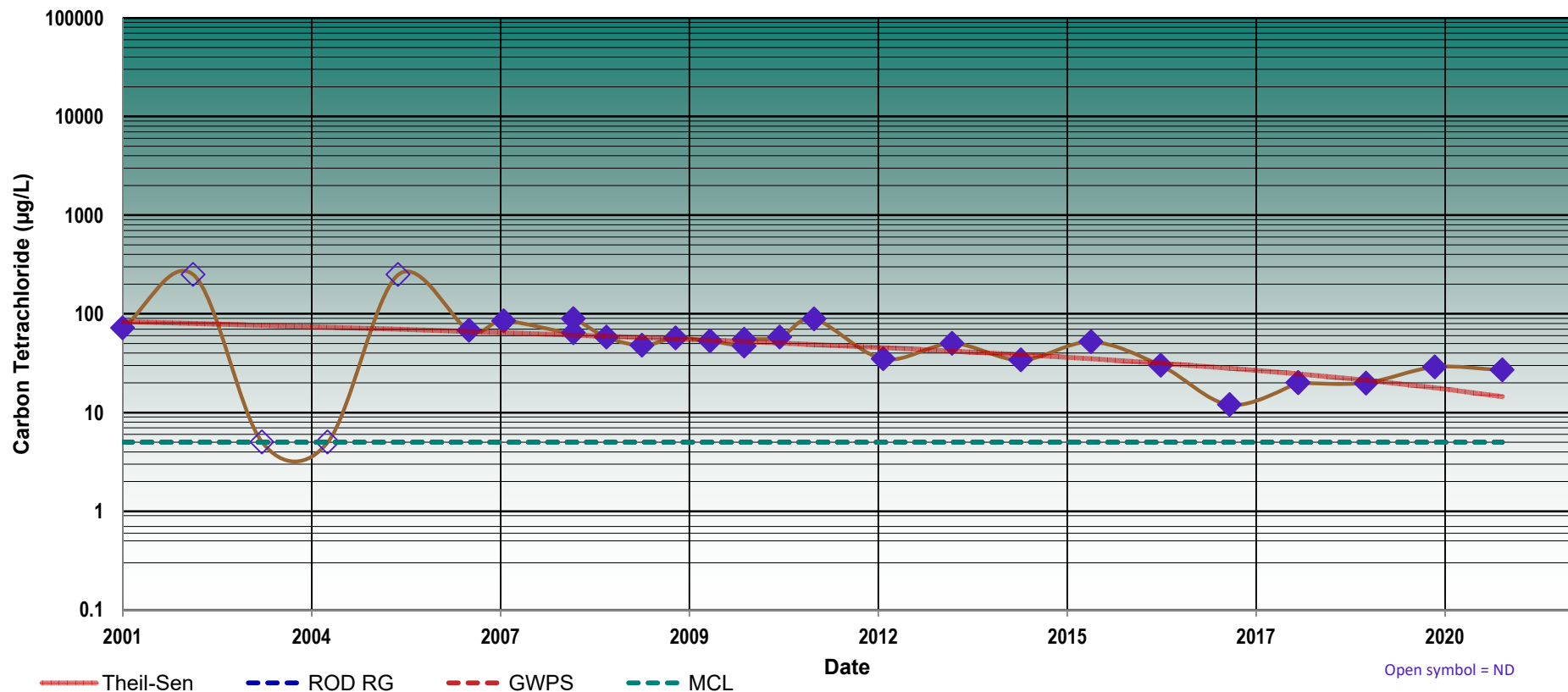


No. Data Pairs = 300	Theil-Sen Slope = 0.00045 µg/L/day	Kendall S = 91	p-Value = 0.0347	Kendall Tau-b = 0.309	
	Most Recent Result (µg/L): 7	Most Recent Date: 7/15/21	Average (µg/L): 5		
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below		Carbon Tetrachloride, µg/L		
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)		GWPS	ROD RG	MCL
			5	5	5
			Exceeds	Exceeds	Exceeds

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-7: Carbon Tetrachloride, µg/L

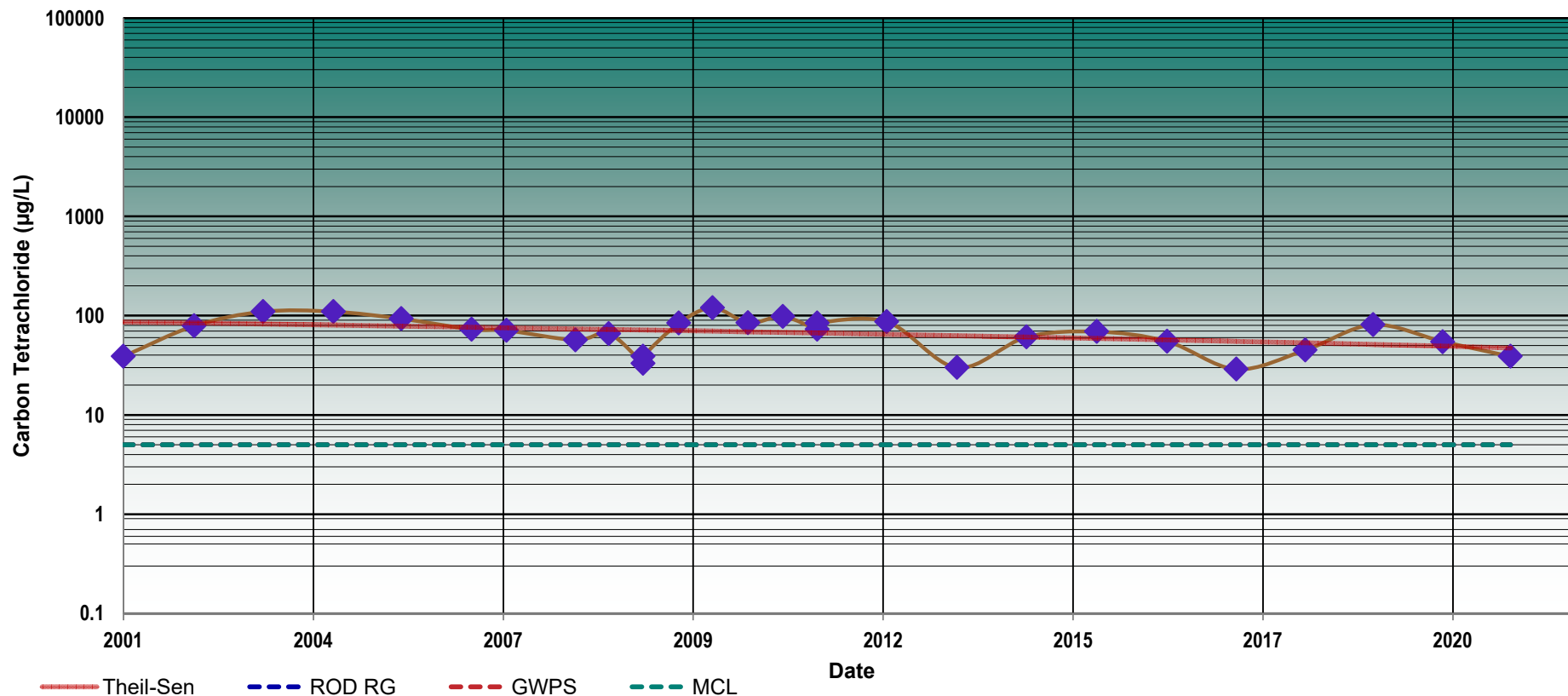


No. Data Pairs = 378	Theil-Sen Slope = -0.00946 µg/L/day	Kendall S = -182	p-Value = 0.0003	Kendall Tau-b = 0.487		
	Most Recent Result (µg/L): 27	Most Recent Date: 7/15/21		Average (µg/L): 60		
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below			Carbon Tetrachloride, µg/L		
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)			GWPS	ROD RG	MCL
				5	5	5
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe			Exceeds	Exceeds	Exceeds

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-8: Carbon Tetrachloride, µg/L

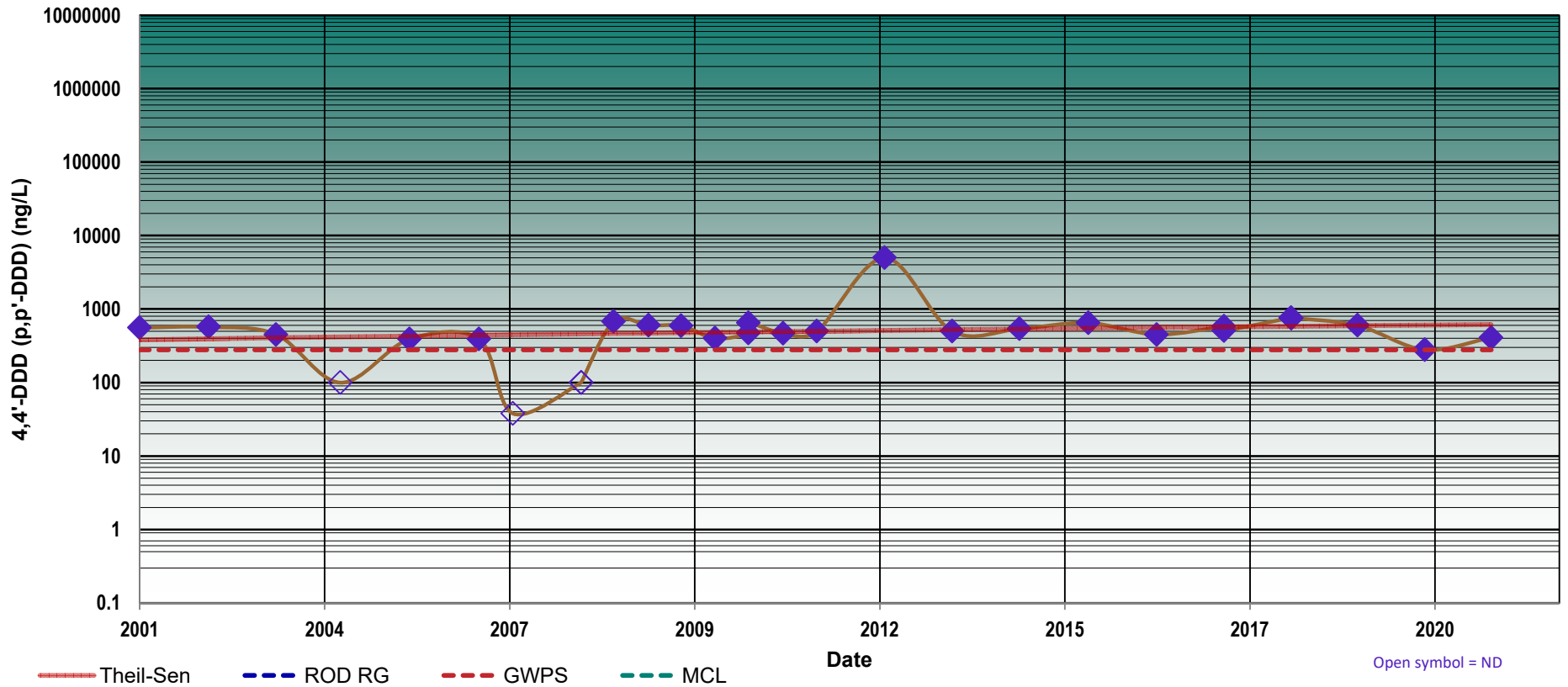


No. Data Pairs = 351		Theil-Sen Slope = -0.00535 µg/L/day		Kendall S = -96		p-Value = 0.0473		Kendall Tau-b = 0.276	
	Most Recent Result (µg/L): 39		Most Recent Date: 7/15/21		Average (µg/L): 69				
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below					Carbon Tetrachloride, µg/L			
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)					GWPS	ROD RG	MCL	
						5	5	5	
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe					Exceeds	Exceeds	Exceeds	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

Mann-Kendall / Theil-Sen
Groundwater Trend Analysis
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-7: 4,4'-DDD (p,p'-DDD), ng/L

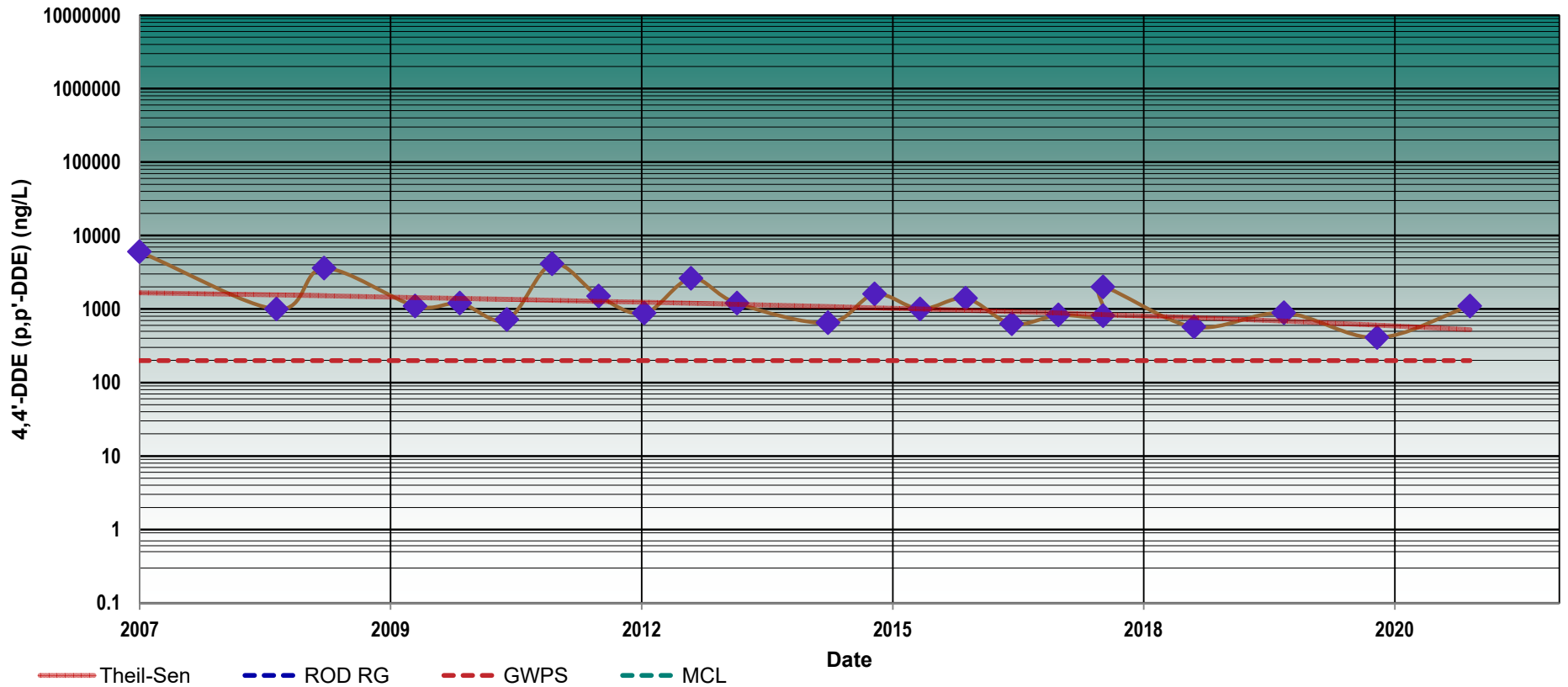


No. Data Pairs = 406		Theil-Sen Slope = 0.03214 ng/L/day		Kendall S = 95		p-Value = 0.0771		Kendall Tau-b = 0.237	
	Most Recent Result (ng/L): 410		Most Recent Date: 7/15/21		Average (ng/L): 624				
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below				4,4'-DDD (p,p'-DDD), ng/L				
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)				GWPS	ROD RG	MCL		
					280	--	--		
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe				Exceeds	OK	OK		

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: OW-2: 4,4'-DDE (p,p'-DDE), ng/L

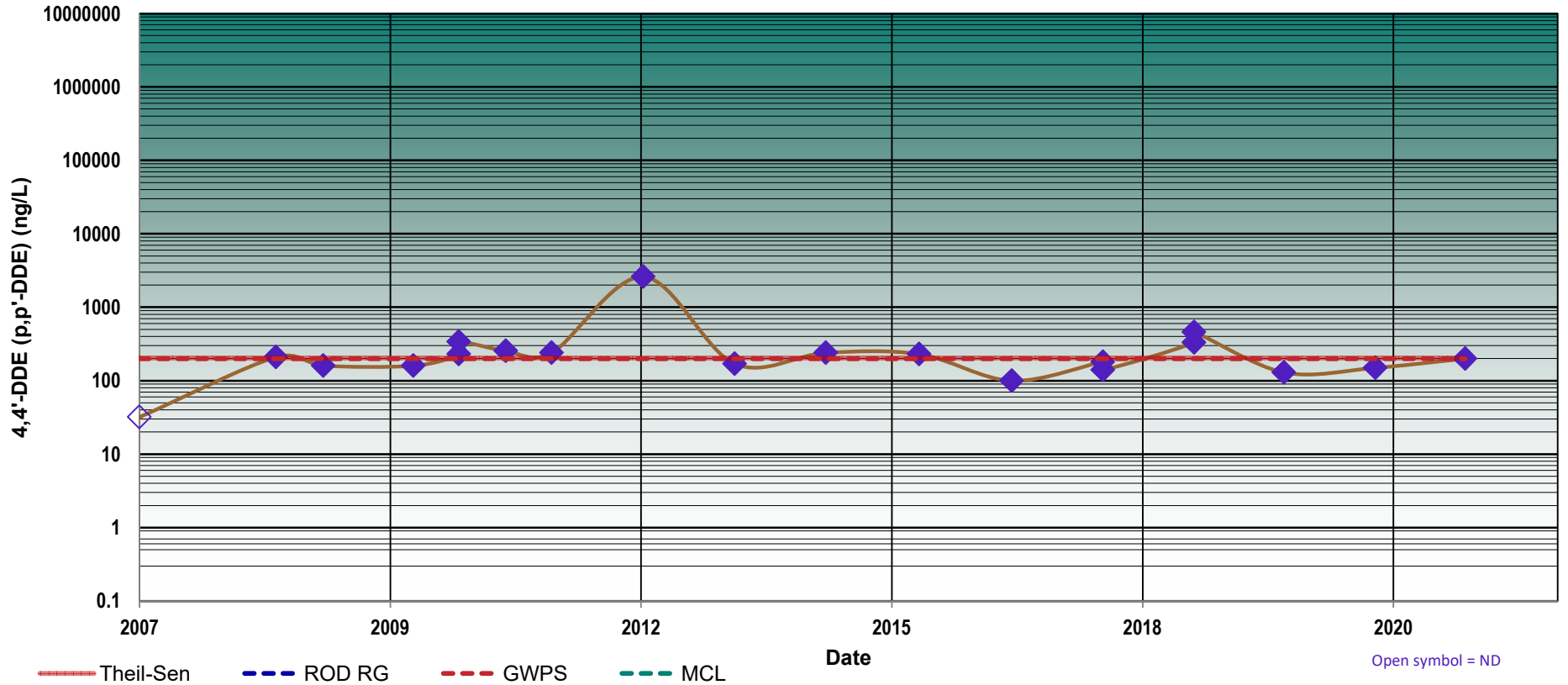


No. Data Pairs = 253		Theil-Sen Slope = -0.21583 ng/L/day		Kendall S = -89		p-Value = 0.0199		Kendall Tau-b = 0.355	
	Most Recent Result (ng/L): 1100		Most Recent Date: 7/28/21		Average (ng/L): 1556				
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below				4,4'-DDE (p,p'-DDE), ng/L				
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)				GWPS	ROD RG	MCL		
					200	--	--		
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe				Exceeds	OK	OK		

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

Mann-Kendall / Theil-Sen
Groundwater Trend Analysis
 Ciba- Geigy Corp (McIntosh Plant) OU1
 McIntosh, Alabama

Alluvial Aquifer: PW-7: 4,4'-DDE (p,p'-DDE), ng/L

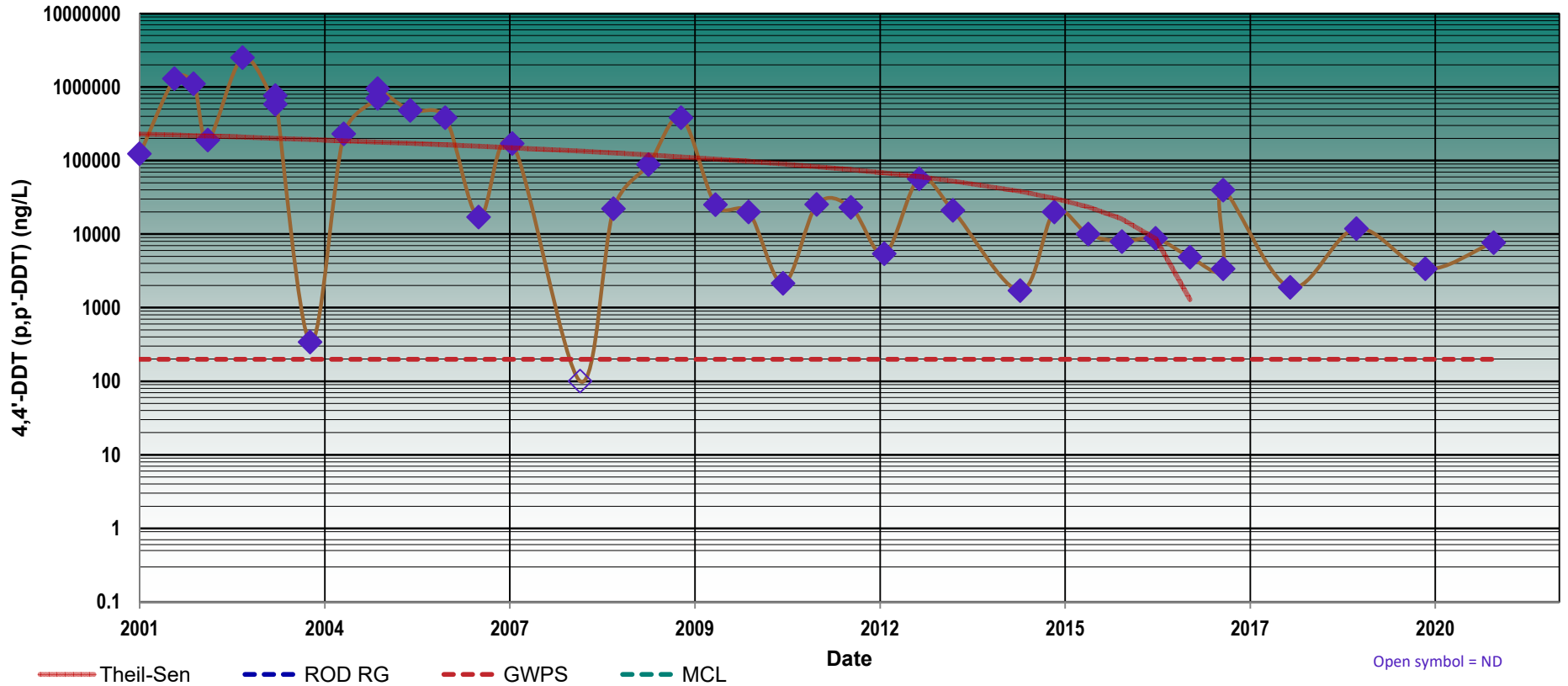


No. Data Pairs = 190		Theil-Sen Slope = 0 ng/L/day		Kendall S = 2		p-Value = 0.974		Kendall Tau-b = 0.011	
	Most Recent Result (ng/L): 200		Most Recent Date: 7/15/21		Average (ng/L): 328				
	Theil-Sen and Kendall DISAGREE on trend direction, check p value below					4,4'-DDE (p,p'-DDE), ng/L			
	p-Value: STATISTICALLY STABLE (p > 0.75 probability greater than 75%)					GWPS	ROD RG	MCL	
						200	--	--	
						OK	OK	OK	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: OW-2: 4,4'-DDT (p,p'-DDT), ng/L

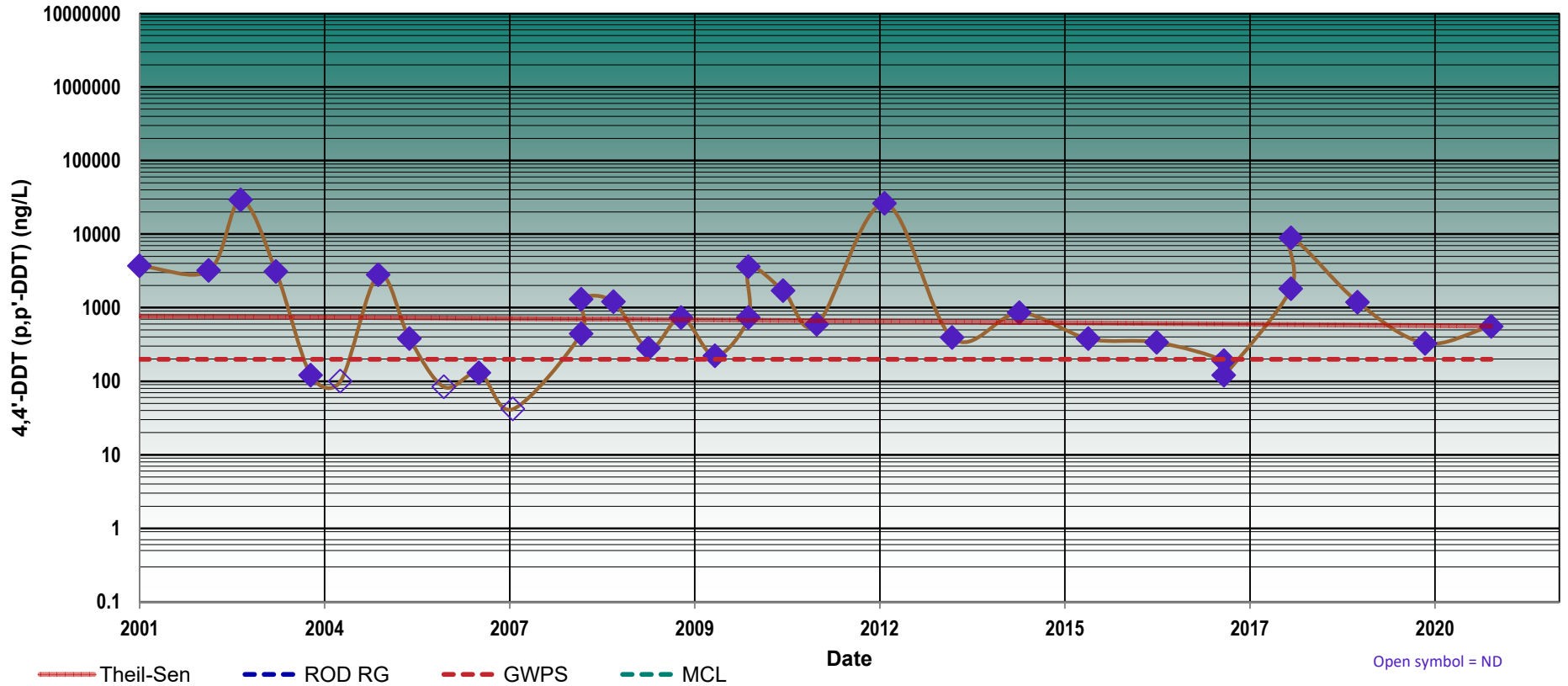


No. Data Pairs = 741		Theil-Sen Slope = -40.37665 ng/L/day		Kendall S = -393		p-Value = 0		Kendall Tau-b = 0.533	
	Most Recent Result (ng/L): 7700		Most Recent Date: 7/28/21		Average (ng/L): 263358				
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below					4,4'-DDT (p,p'-DDT), ng/L			
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)					GWPS	ROD RG	MCL	
						200	--	--	
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe					Exceeds	OK	OK	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-7: 4,4'-DDT (p,p'-DDT), ng/L

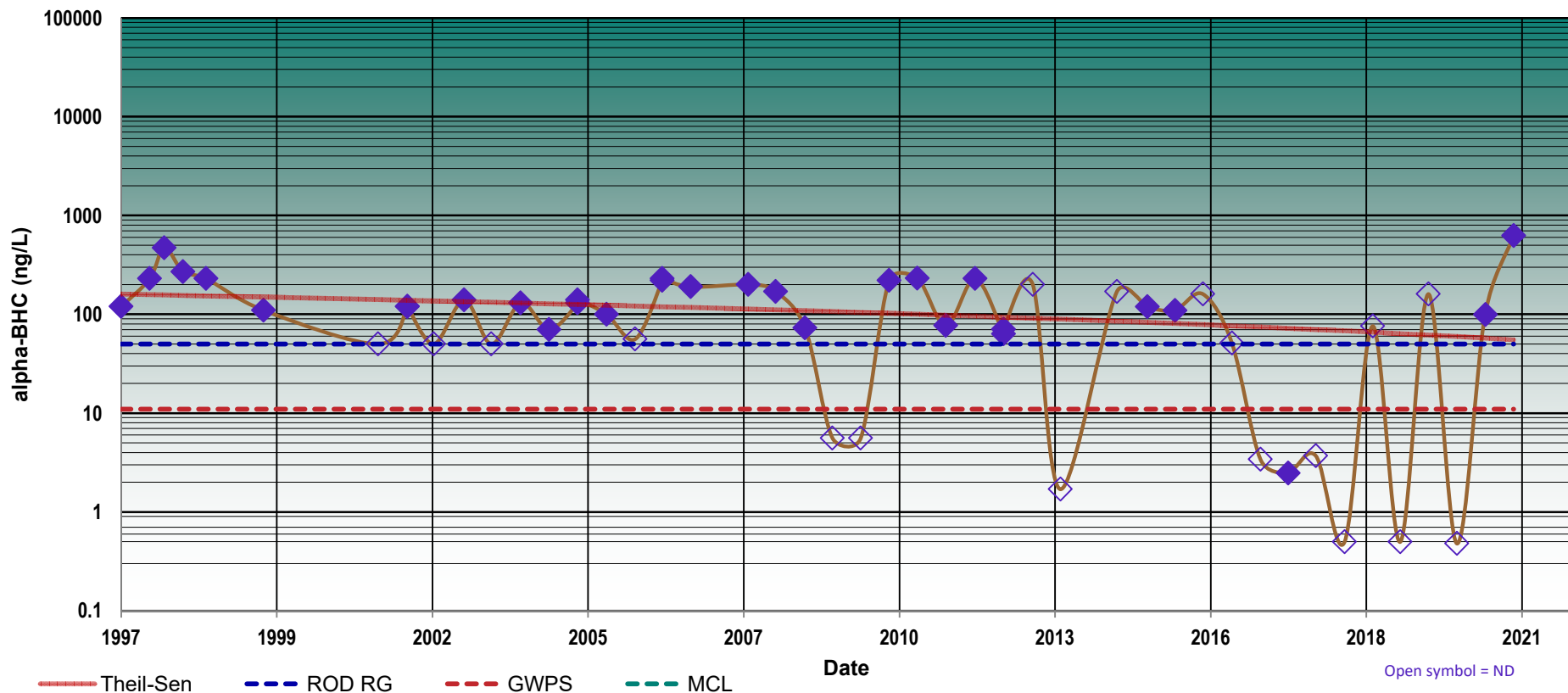


No. Data Pairs = 528		Theil-Sen Slope = -0.02876 ng/L/day		Kendall S = -32		p-Value = 0.6307		Kendall Tau-b = 0.061	
	Most Recent Result (ng/L): 560		Most Recent Date: 7/15/21		Average (ng/L): 2864				
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below					4,4'-DDT (p,p'-DDT), ng/L			
	p-Value: LIKELY STATISTICALLY STABLE (p = 0.2 to 0.75 low probability that the trend is valid)					GWPS	ROD RG	MCL	
						200	--	--	
						Exceeds	OK	OK	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: M-3: alpha-BHC, ng/L

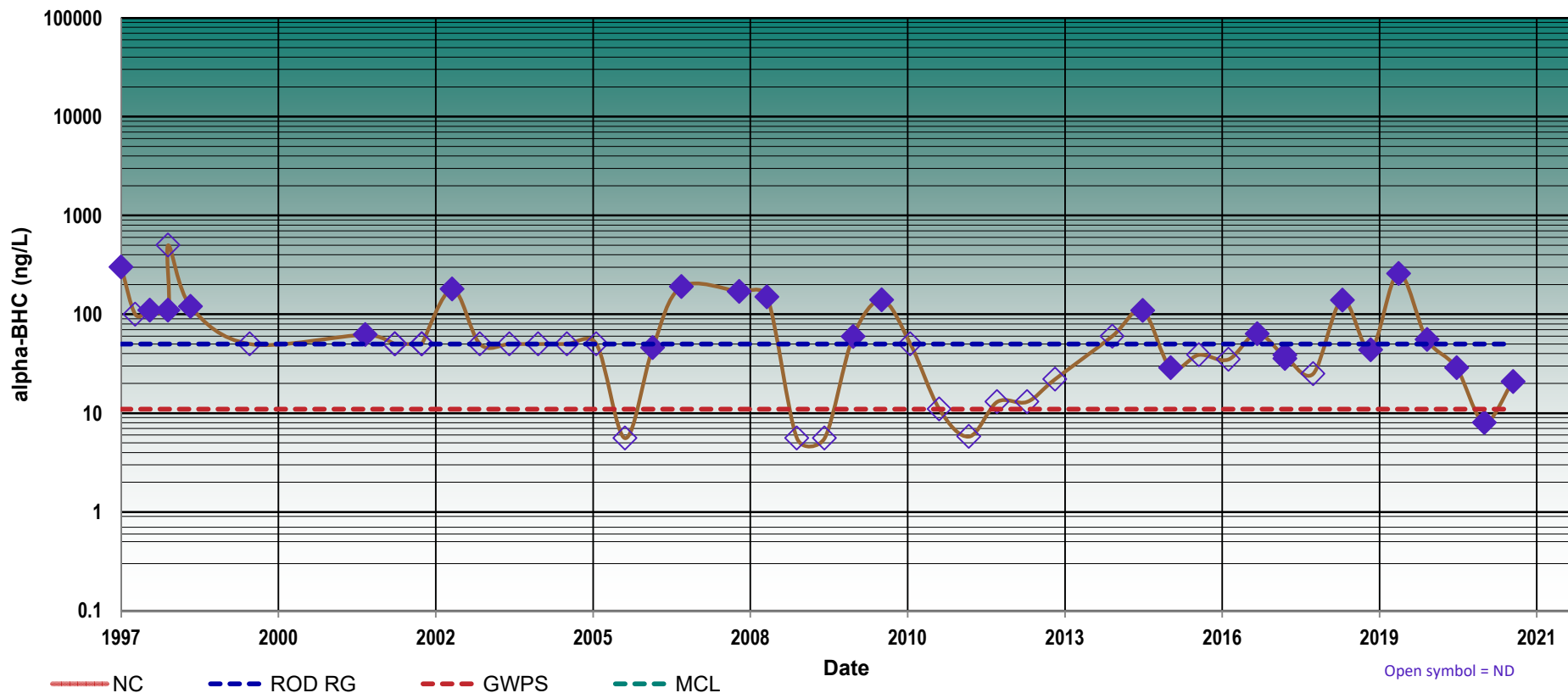


No. Data Pairs = 1176	Theil-Sen Slope = -0.01171 ng/L/day	Kendall S = -282	p-Value = 0.0153	Kendall Tau-b = 0.242	
	Most Recent Result (ng/L): 630	Most Recent Date: 7/8/21	Average (ng/L): 130		
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below		alpha-BHC, ng/L		
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)		GWPS	ROD RG	MCL
			11	50	--
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe		Exceeds	Exceeds	OK

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

Mann-Kendall / Theil-Sen
Groundwater Trend Analysis
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: M-4: alpha-BHC, ng/L

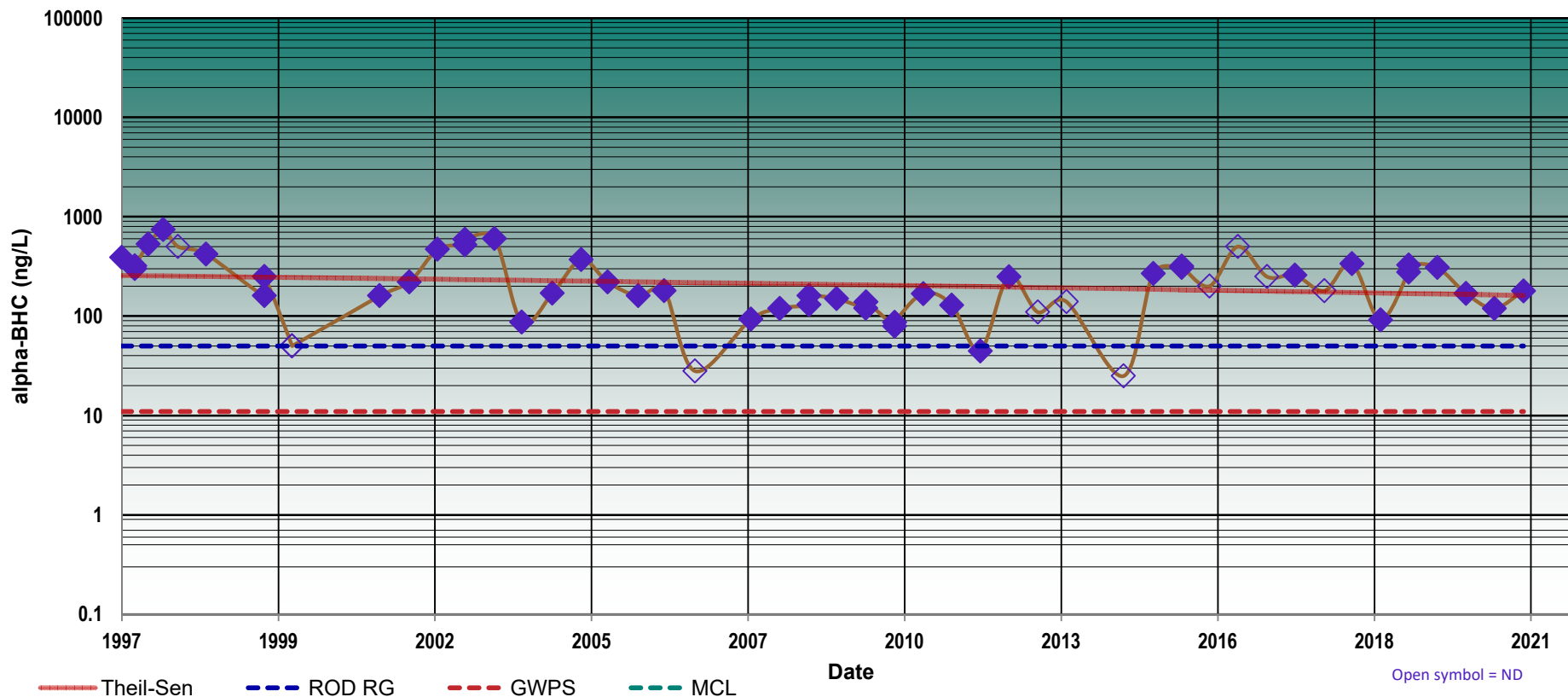


No. Data Pairs = 1176	Theil-Sen Slope = NC ng/L/day	Kendall S = NC	p-Value = NC	Kendall Tau-b = NC		
	Most Recent Result (ng/L): 21	Most Recent Date: 7/8/21		Average (ng/L): 79		
	NC			alpha-BHC, ng/L		
	NC			GWPS	ROD RG	MCL
				11	50	--
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe			Exceeds	OK	OK
	NC - Statistics not calculated, requires 50% detections					

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: OW-4: alpha-BHC, ng/L

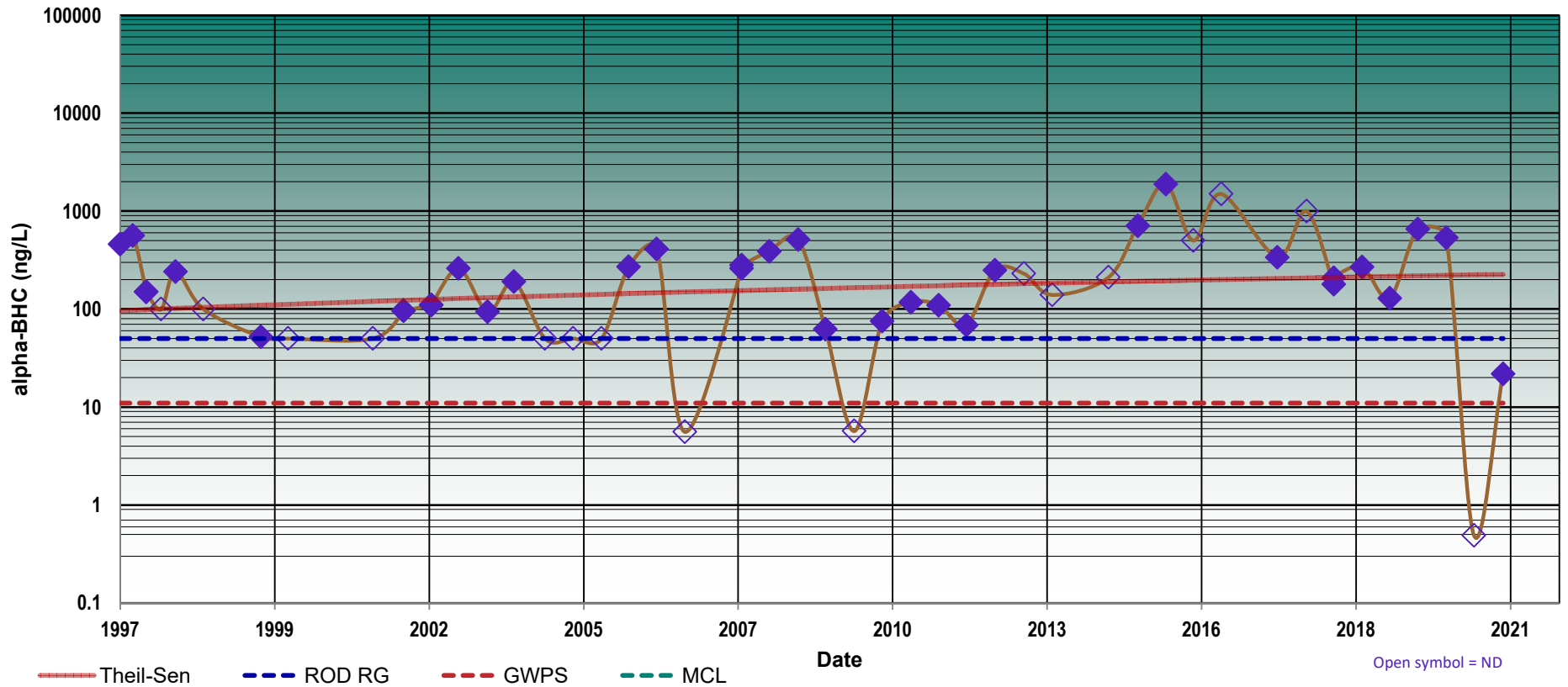


No. Data Pairs = 1540		Theil-Sen Slope = -0.01064 ng/L/day		Kendall S = -183		p-Value = 0.198		Kendall Tau-b = 0.12		
	Most Recent Result (ng/L): 180		Most Recent Date: 7/19/21		Average (ng/L): 242					
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below					alpha-BHC, ng/L				
	p-Value: LIKELY VALID STATISTICAL TREND (p = 0.1 to 0.2 probability from 90% to 80%)					GWPS		ROD RG		MCL
						11		50		--
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe					Exceeds		Exceeds		OK

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: OW-6: alpha-BHC, ng/L

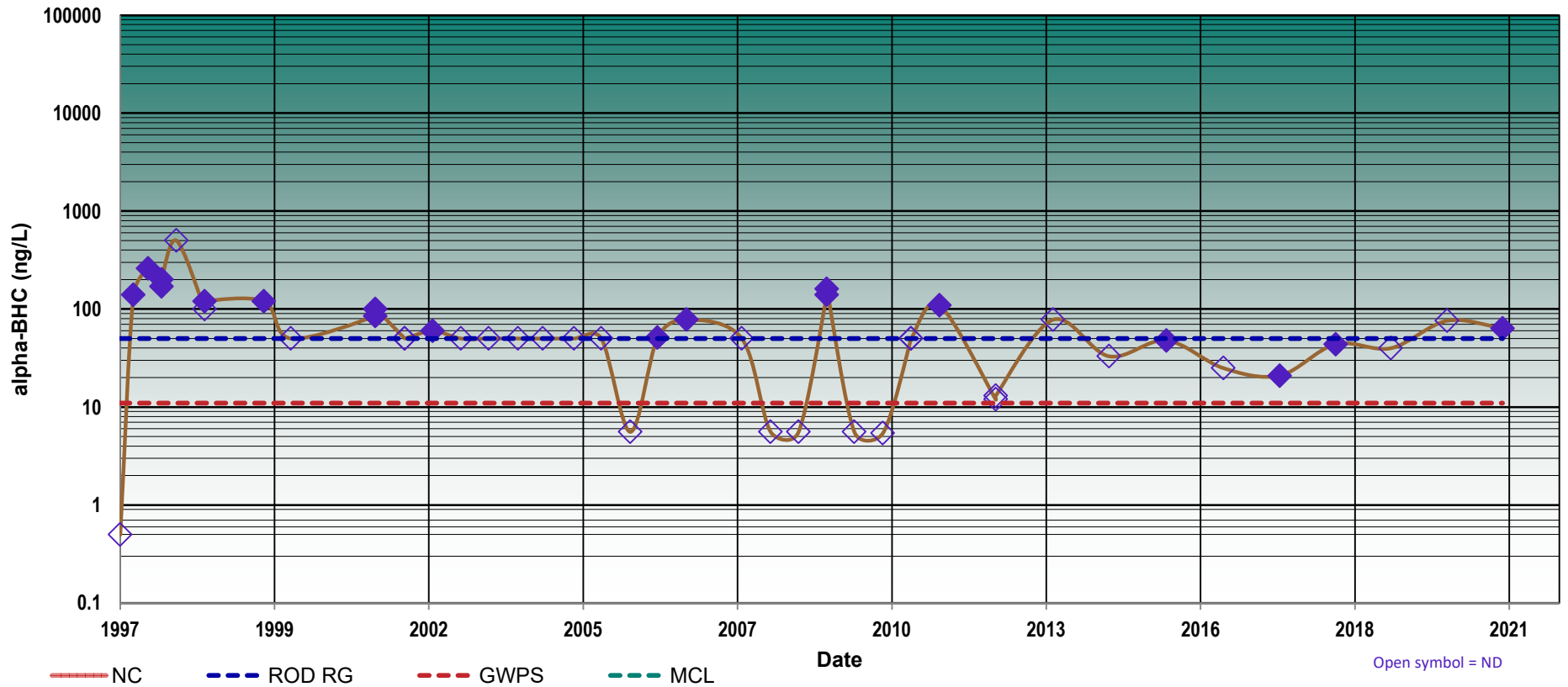


No. Data Pairs = 1275		Theil-Sen Slope = 0.01454 ng/L/day		Kendall S = 206		p-Value = 0.0956		Kendall Tau-b = 0.163	
	Most Recent Result (ng/L): 22		Most Recent Date: 7/19/21		Average (ng/L): 282				
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below					alpha-BHC, ng/L			
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)					GWPS	ROD RG	MCL	
						11	50	--	
						Exceeds	OK	OK	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-1: alpha-BHC, ng/L

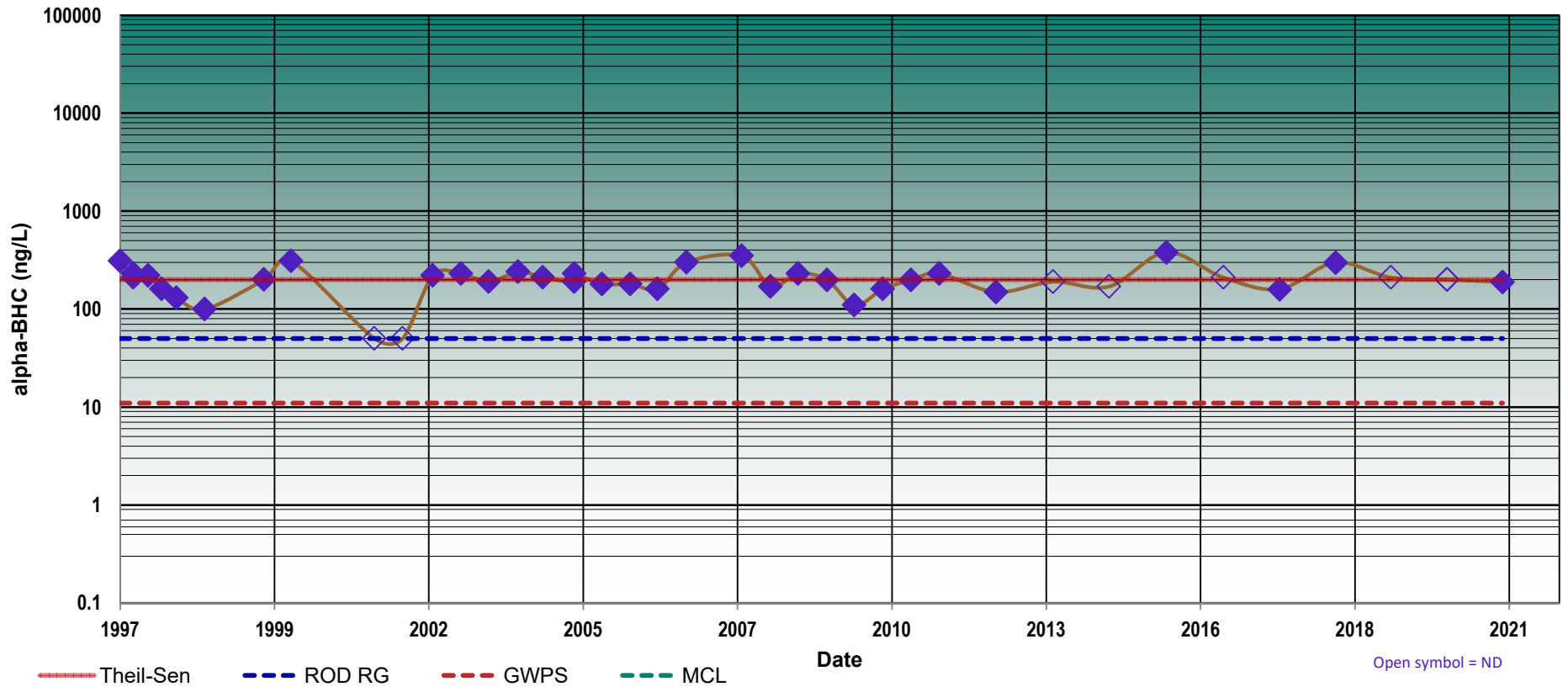


No. Data Pairs = 990	Theil-Sen Slope = NC ng/L/day	Kendall S = NC	p-Value = NC	Kendall Tau-b = NC
Most Recent Result (ng/L): 64		Most Recent Date: 7/15/21		Average (ng/L): 77
NC		alpha-BHC, ng/L		
NC		GWPS	ROD RG	MCL
STABLE FOR ALL PRACTICAL PURPOSES		11	50	--
Slope insufficient to achieve the GPS in a reasonable timeframe		Exceeds	Exceeds	OK
NC - Statistics not calculated, requires 50% detections				

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-2: alpha-BHC, ng/L

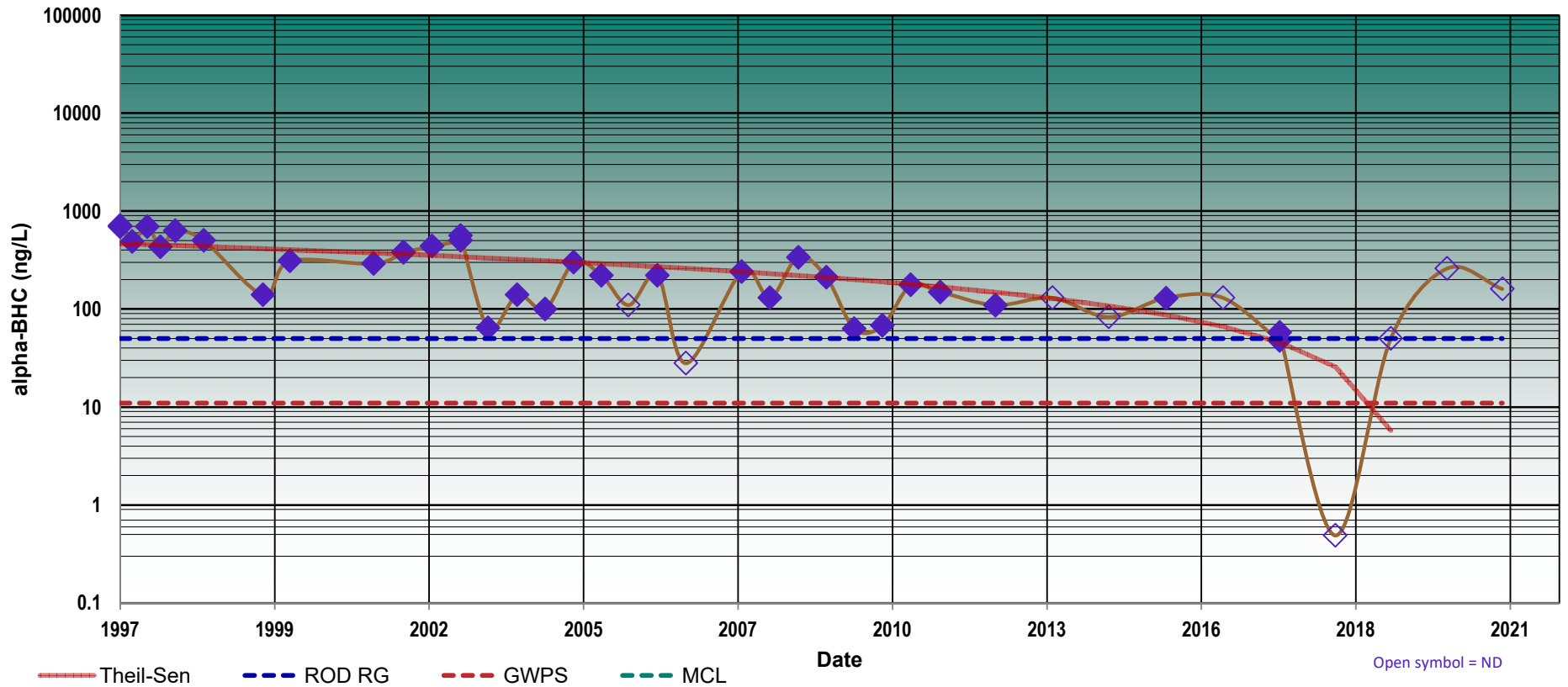


No. Data Pairs = 820		Theil-Sen Slope = 0 ng/L/day		Kendall S = -11		p-Value = 0.9103		Kendall Tau-b = 0.014	
	Most Recent Result (ng/L): 190		Most Recent Date: 7/15/21		Average (ng/L): 203				
	Theil-Sen and Kendall DISAGREE on trend direction, check p value below					alpha-BHC, ng/L			
	p-Value: STATISTICALLY STABLE (p > 0.75 probability greater than 75%)					GWPS	ROD RG	MCL	
						11	50	--	
						Exceeds	Exceeds	OK	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-3: alpha-BHC, ng/L

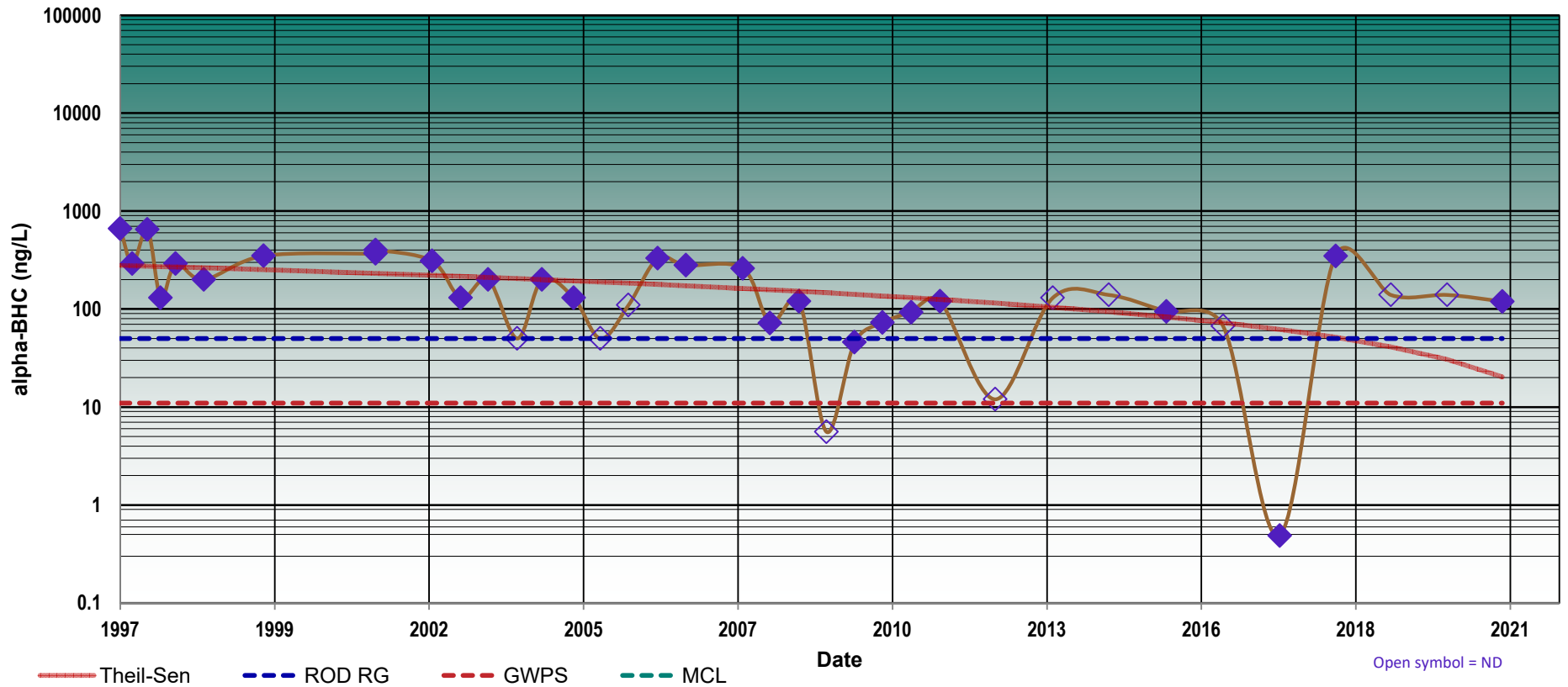


No. Data Pairs = 861		Theil-Sen Slope = -0.05582 ng/L/day		Kendall S = -474		p-Value = 0		Kendall Tau-b = 0.554	
	Most Recent Result (ng/L): Not Detected		Most Recent Date: 7/15/21			Average (ng/L): 259			
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below					alpha-BHC, ng/L			
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)					GWPS	ROD RG	MCL	
						11	50	--	
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe					OK	OK	OK	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

Mann-Kendall / Theil-Sen
Groundwater Trend Analysis
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

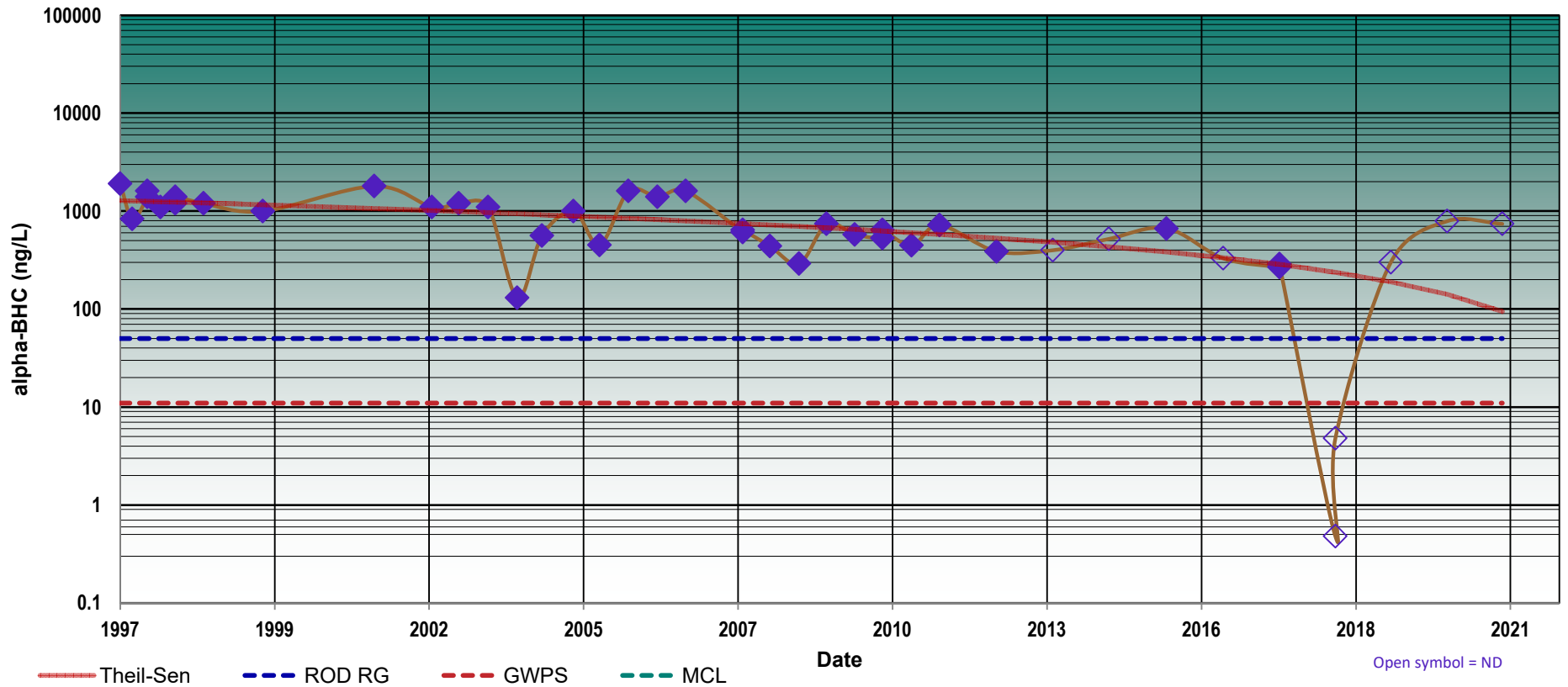
Alluvial Aquifer: PW-6: alpha-BHC, ng/L



No. Data Pairs = 666		Theil-Sen Slope = -0.0289 ng/L/day		Kendall S = -246		p-Value = 0.0013		Kendall Tau-b = 0.373	
	Most Recent Result (ng/L): 120		Most Recent Date: 7/14/21		Average (ng/L): 192				
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below				alpha-BHC, ng/L				
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)				GWPS	ROD RG	MCL		
					11	50	--		
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe				Exceeds	Exceeds	OK		

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

Alluvial Aquifer: PW-7: alpha-BHC, ng/L

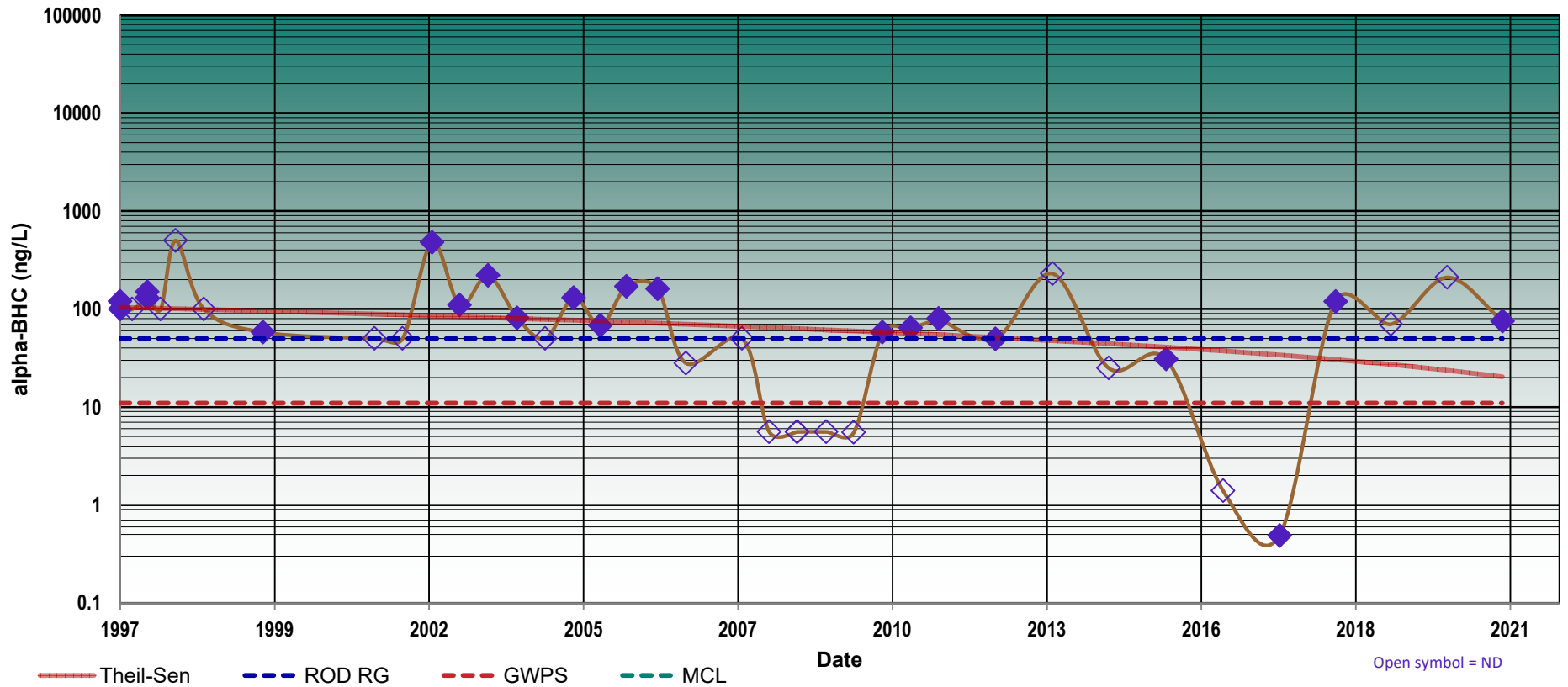


No. Data Pairs = 861		Theil-Sen Slope = -0.13255 ng/L/day		Kendall S = -443		p-Value = 0		Kendall Tau-b = 0.52				
	Most Recent Result (ng/L):		Not Detected		Most Recent Date:		7/15/21		Average (ng/L): 807			
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below						alpha-BHC, ng/L					
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)						GWPS		ROD RG		MCL	
							11		50		--	
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe						OK		OK		OK	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

Mann-Kendall / Theil-Sen
Groundwater Trend Analysis
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-8: alpha-BHC, ng/L

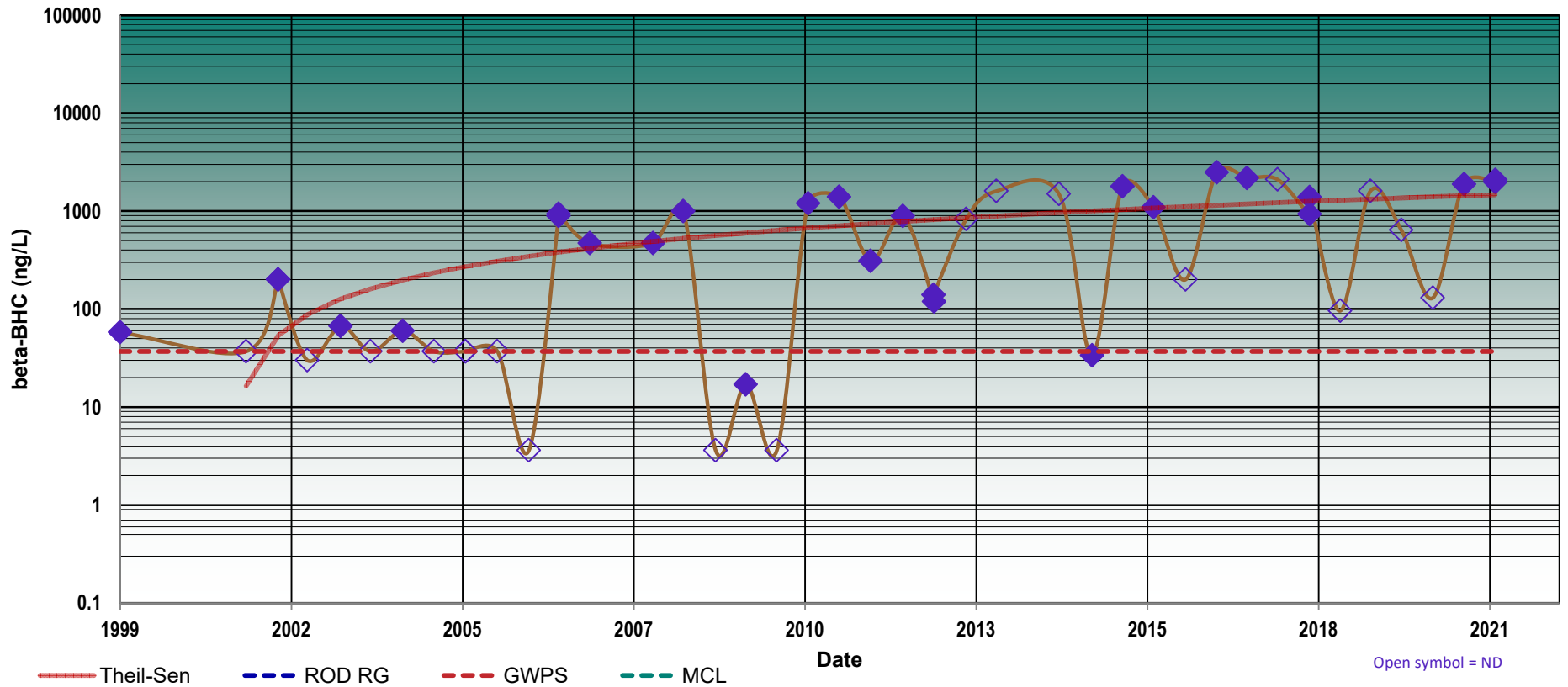


No. Data Pairs = 820		Theil-Sen Slope = -0.00936 ng/L/day		Kendall S = -215		p-Value = 0.016		Kendall Tau-b = 0.266			
	Most Recent Result (ng/L): 76			Most Recent Date: 7/15/21		Average (ng/L): 101					
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below					alpha-BHC, ng/L					
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)					GWPS		ROD RG		MCL	
						11		50		--	
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe					Exceeds		Exceeds		OK	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

Mann-Kendall / Theil-Sen
Groundwater Trend Analysis
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: M-3: beta-BHC, ng/L

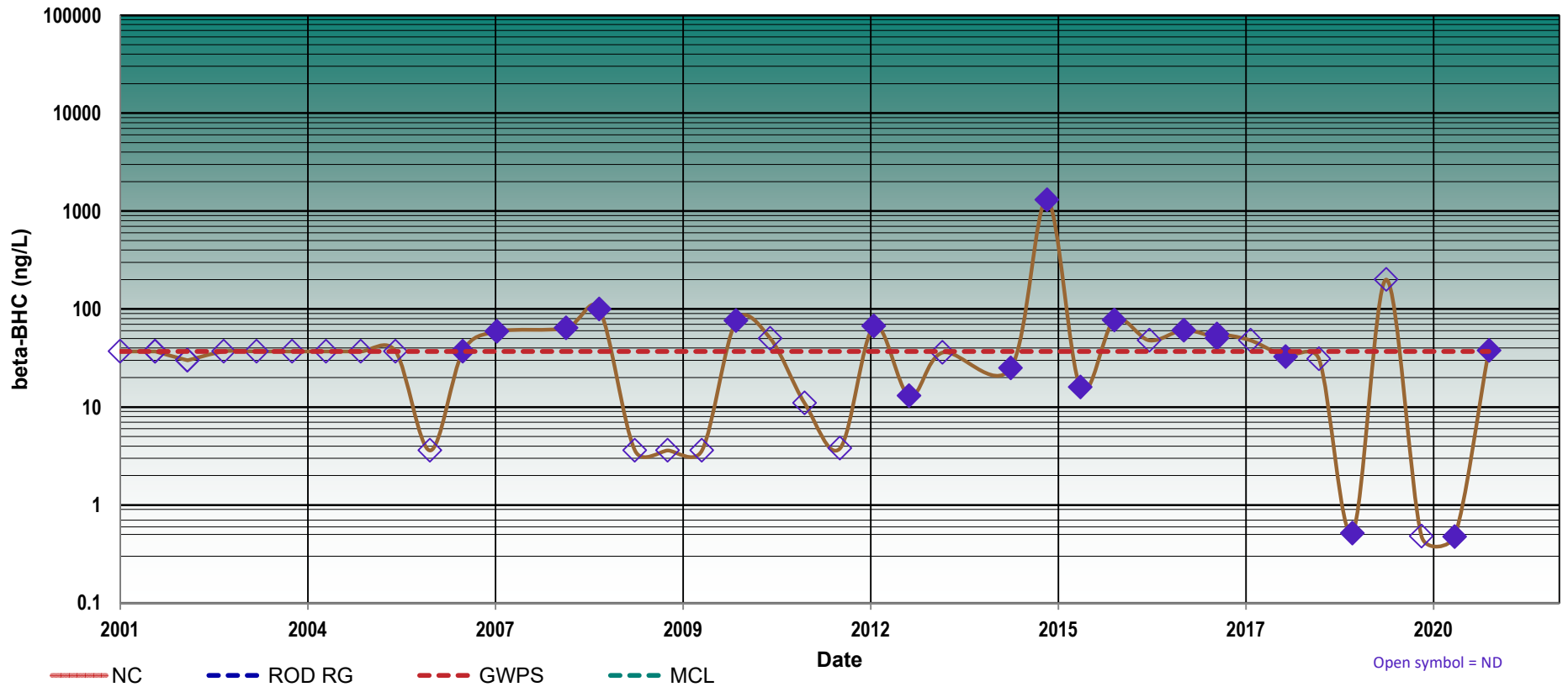


No. Data Pairs = 1035		Theil-Sen Slope = 0.1994 ng/L/day		Kendall S = 437		p-Value = 0		Kendall Tau-b = 0.428	
	Most Recent Result (ng/L): 2100		Most Recent Date: 7/8/21		Average (ng/L): 725				
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below					beta-BHC, ng/L			
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)					GWPS	ROD RG	MCL	
						37	--	--	
						Exceeds	OK	OK	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: M-4: beta-BHC, ng/L

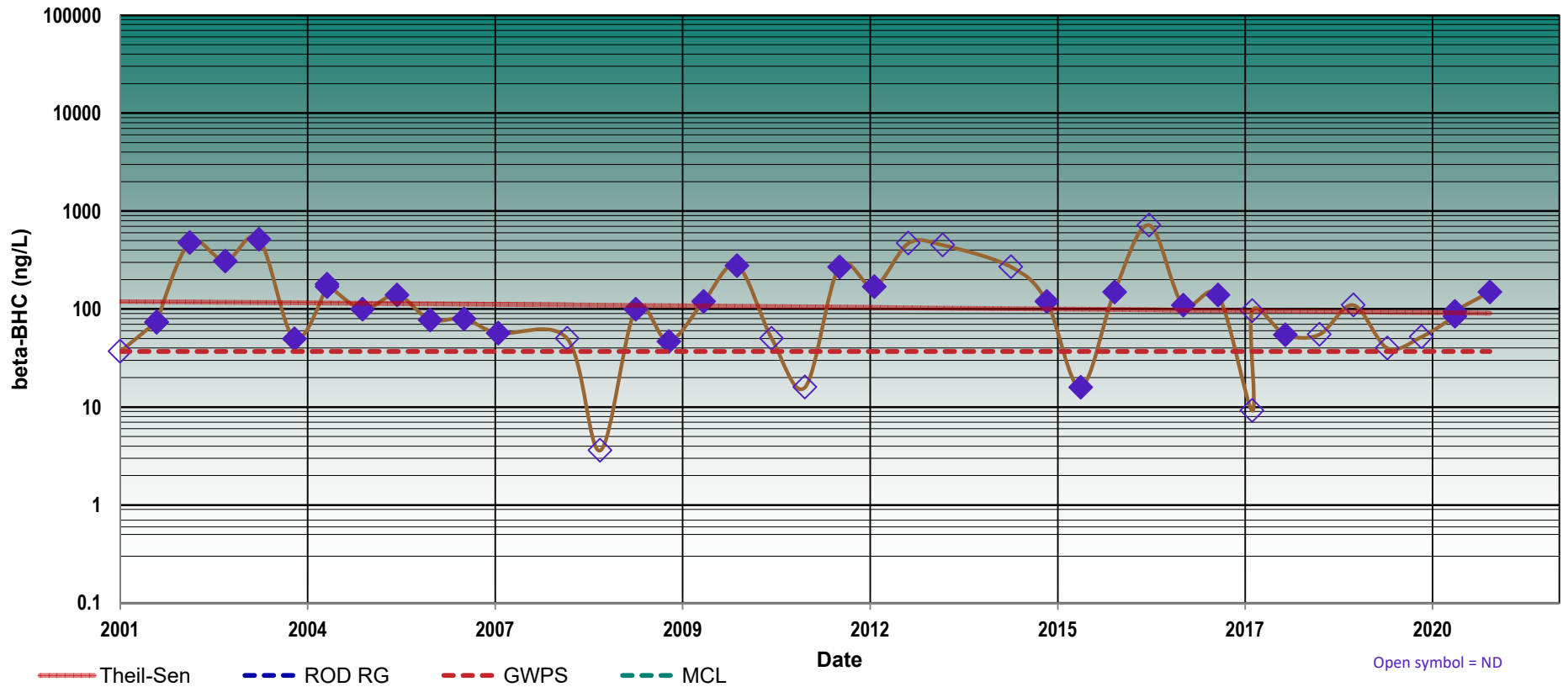


No. Data Pairs = 861		Theil-Sen Slope = NC ng/L/day		Kendall S = NC		p-Value = NC		Kendall Tau-b = NC	
	Most Recent Result (ng/L): 38		Most Recent Date: 7/8/21		Average (ng/L): 69				
	NC				beta-BHC, ng/L				
	NC				GWPS	ROD RG	MCL		
					37	--	--		
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe				Exceeds	OK	OK		
NC - Statistics not calculated, requires 50% detections									

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: MW-9A: beta-BHC, ng/L

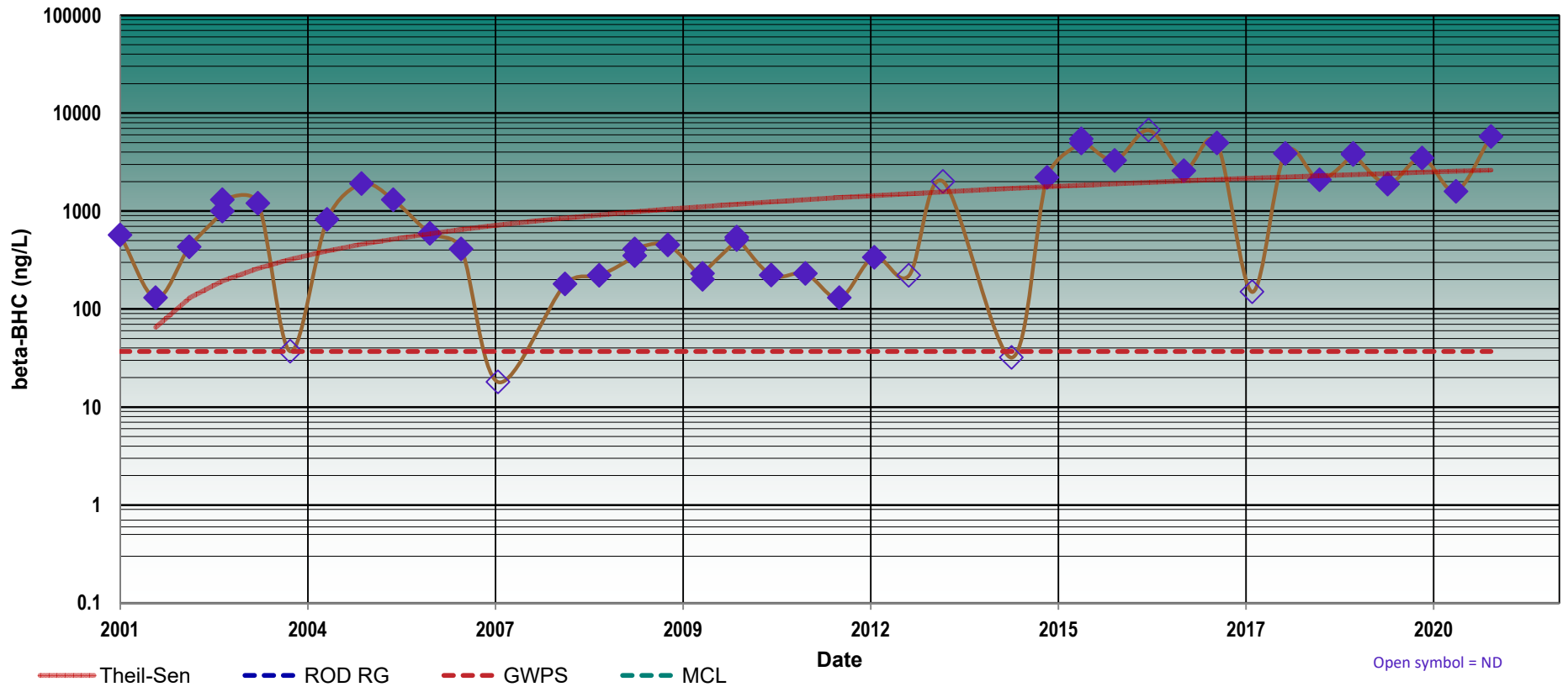


No. Data Pairs = 903		Theil-Sen Slope = -0.00391 ng/L/day		Kendall S = -67		p-Value = 0.4894		Kendall Tau-b = 0.075	
	Most Recent Result (ng/L): 150		Most Recent Date: 7/13/21		Average (ng/L): 155				
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below					beta-BHC, ng/L			
	p-Value: LIKELY STATISTICALLY STABLE (p = 0.2 to 0.75 low probability that the trend is valid)					GWPS	ROD RG	MCL	
						37	--	--	
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe					Exceeds	OK	OK	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

Mann-Kendall / Theil-Sen
Groundwater Trend Analysis
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: OW-4: beta-BHC, ng/L

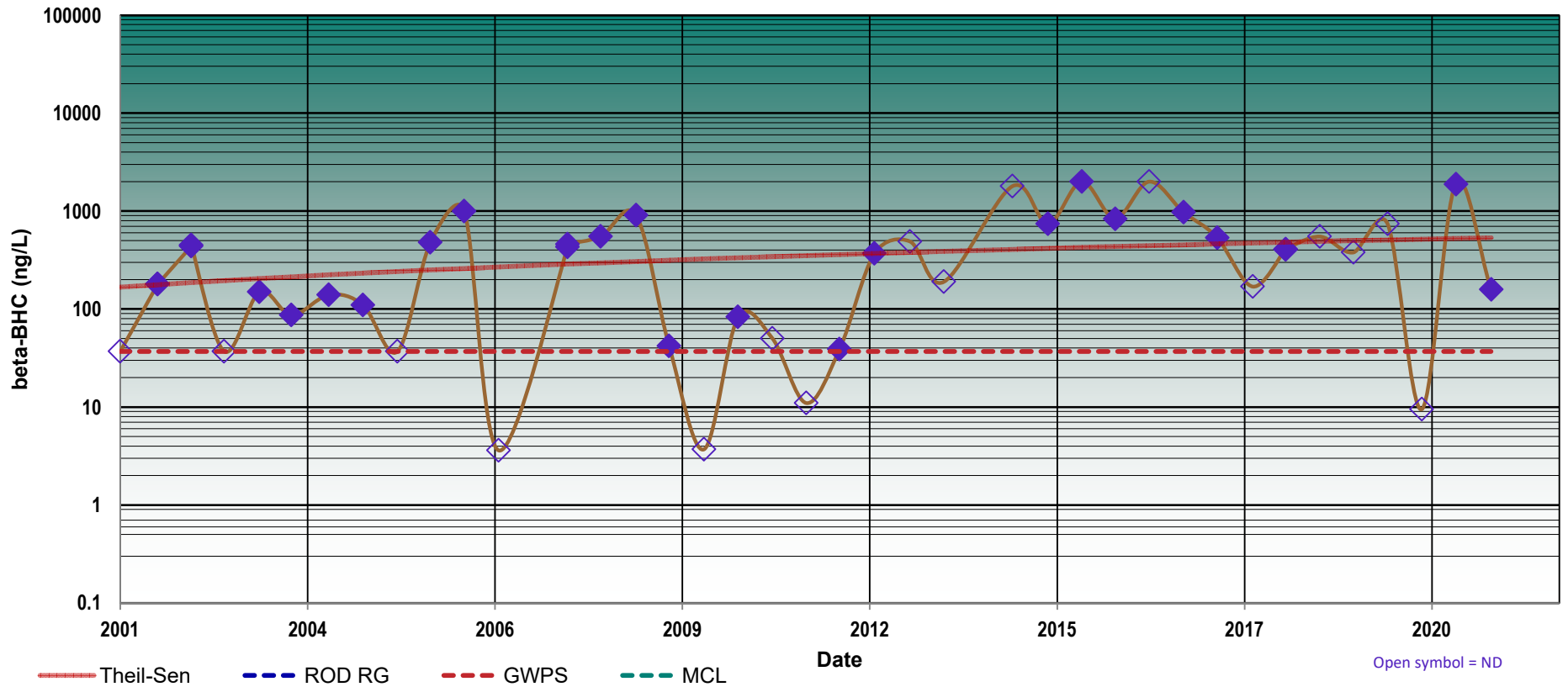


No. Data Pairs = 990		Theil-Sen Slope = 0.35879 ng/L/day		Kendall S = 299		p-Value = 0.0035		Kendall Tau-b = 0.304	
	Most Recent Result (ng/L): 5800		Most Recent Date: 7/19/21		Average (ng/L): 1620				
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below					beta-BHC, ng/L			
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)					GWPS	ROD RG	MCL	
						37	--	--	
						Exceeds	OK	OK	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: OW-6: beta-BHC, ng/L

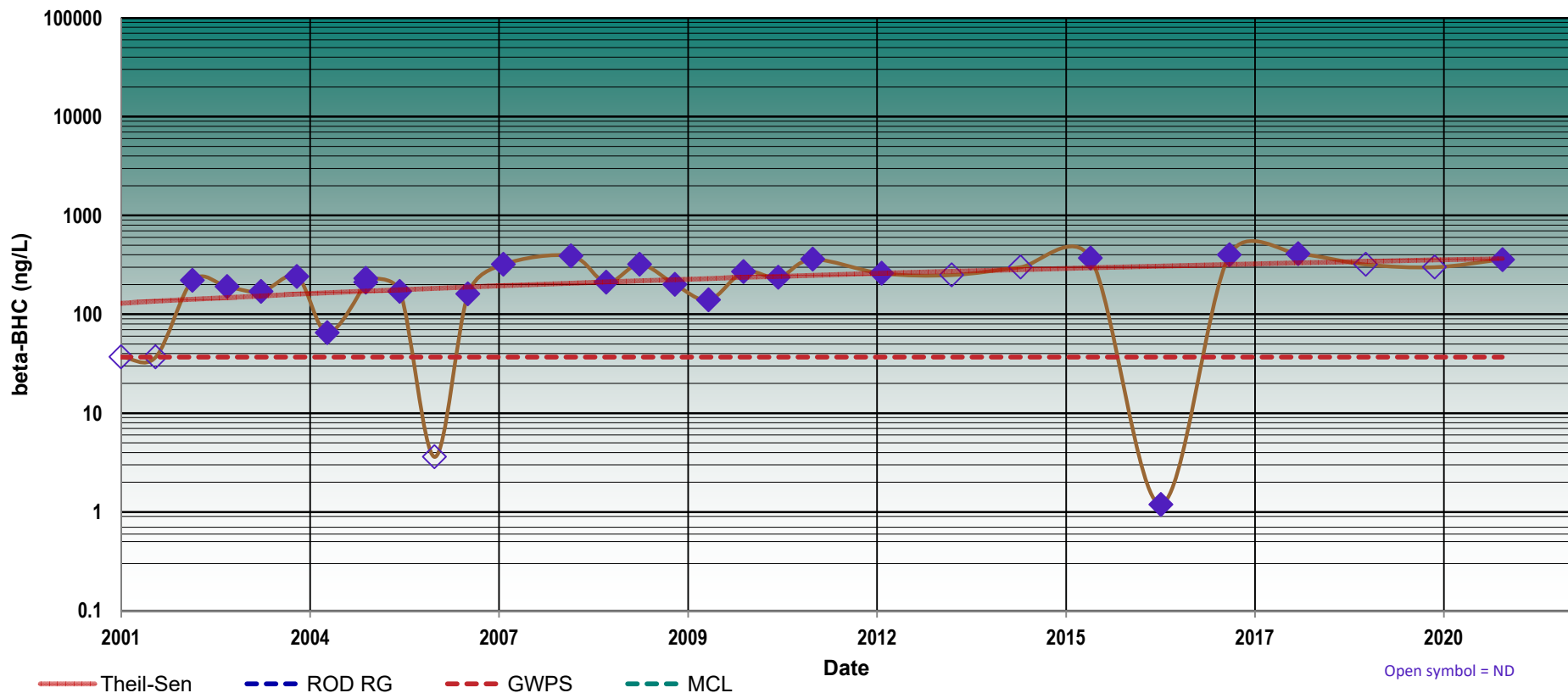


No. Data Pairs = 903		Theil-Sen Slope = 0.05034 ng/L/day		Kendall S = 203		p-Value = 0.0344		Kendall Tau-b = 0.226	
	Most Recent Result (ng/L): 160		Most Recent Date: 7/19/21		Average (ng/L): 479				
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below					beta-BHC, ng/L			
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)					GWPS	ROD RG	MCL	
						37	--	--	
						Exceeds	OK	OK	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

Mann-Kendall / Theil-Sen
Groundwater Trend Analysis
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-2: beta-BHC, ng/L

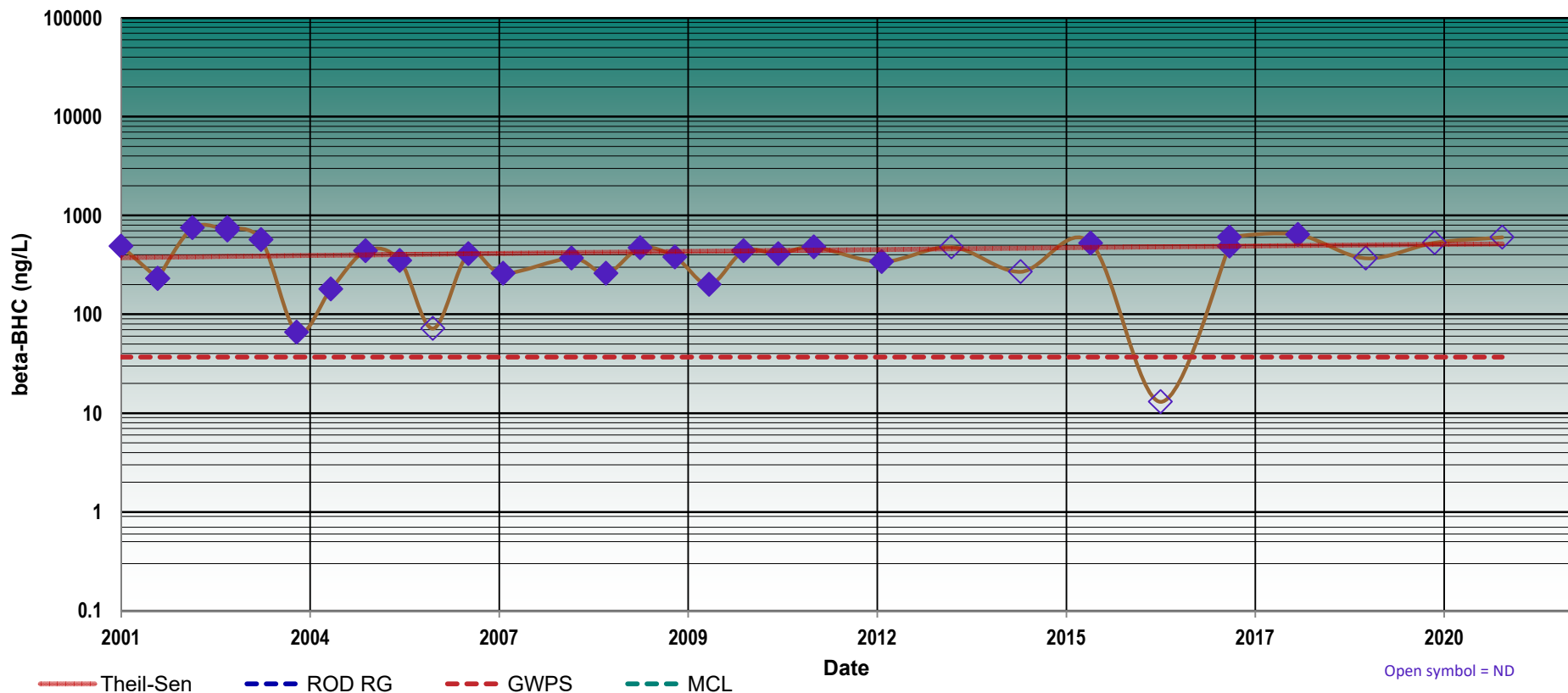


No. Data Pairs = 465		Theil-Sen Slope = 0.0324 ng/L/day		Kendall S = 205		p-Value = 0.0005		Kendall Tau-b = 0.445	
	Most Recent Result (ng/L): 360		Most Recent Date: 7/15/21		Average (ng/L): 231				
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below					beta-BHC, ng/L			
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)					GWPS	ROD RG	MCL	
						37	--	--	
						Exceeds	OK	OK	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

Mann-Kendall / Theil-Sen
Groundwater Trend Analysis
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-3: beta-BHC, ng/L

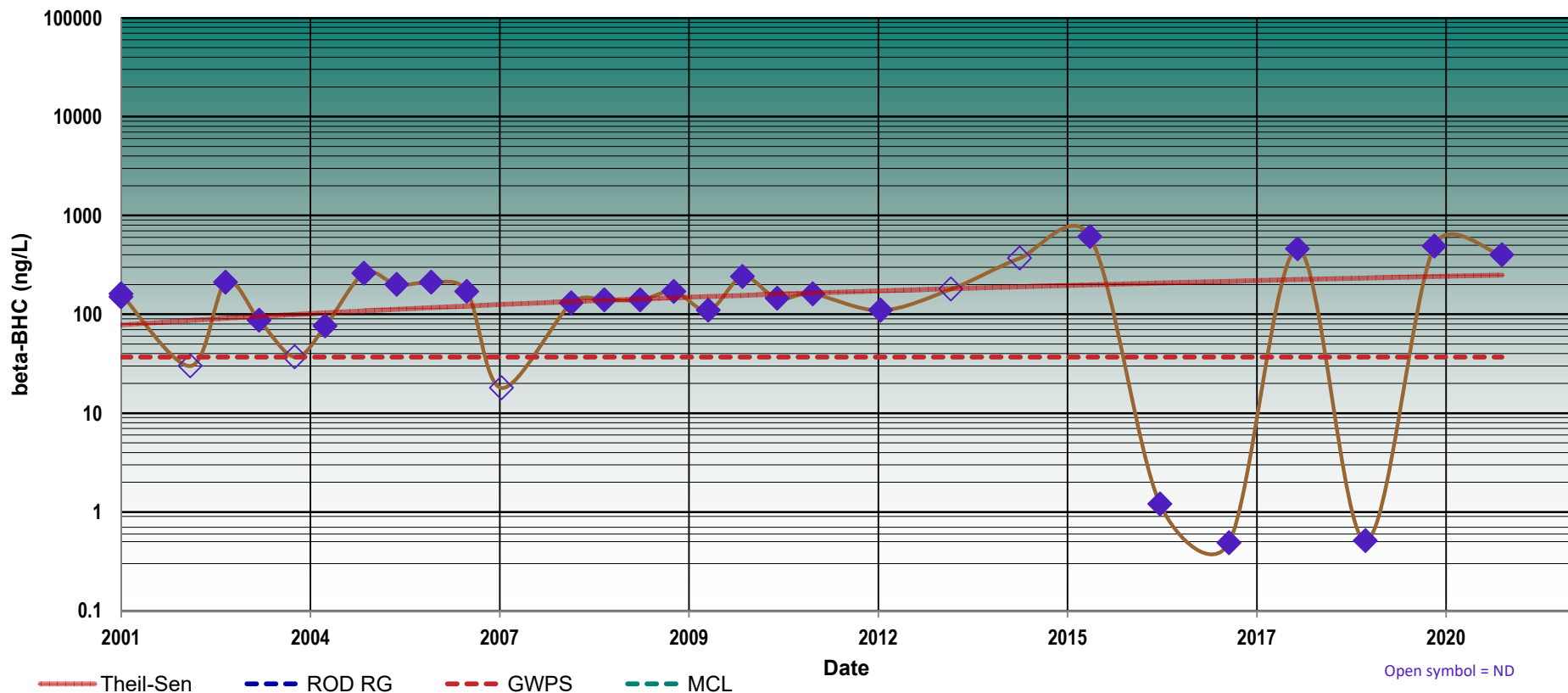


No. Data Pairs = 528	Theil-Sen Slope = 0.01957 ng/L/day	Kendall S = 74	p-Value = 0.2574	Kendall Tau-b = 0.141			
	Most Recent Result (ng/L):	Not Detected	Most Recent Date:	7/15/21	Average (ng/L):	405	
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below				beta-BHC, ng/L		
	p-Value: LIKELY STATISTICALLY STABLE (p = 0.2 to 0.75 low probability that the trend is valid)				GWPS	ROD RG	MCL
					37	--	--
					OK	OK	OK

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

Mann-Kendall / Theil-Sen
Groundwater Trend Analysis
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-6: beta-BHC, ng/L

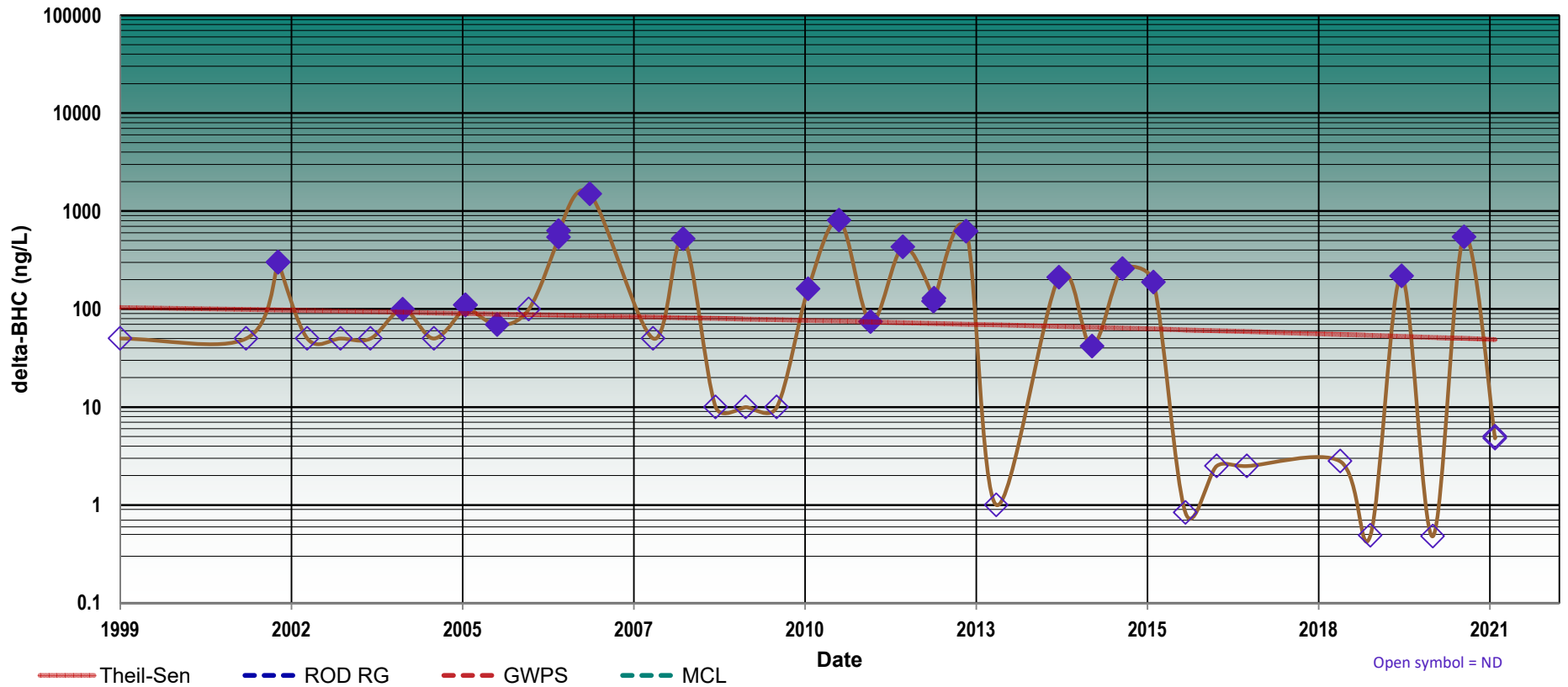


No. Data Pairs = 435	Theil-Sen Slope = 0.02355 ng/L/day	Kendall S = 63	p-Value = 0.2682	Kendall Tau-b = 0.146		
	Most Recent Result (ng/L): 400	Most Recent Date: 7/14/21		Average (ng/L): 182		
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below			beta-BHC, ng/L		
	p-Value: LIKELY STATISTICALLY STABLE (p = 0.2 to 0.75 low probability that the trend is valid)			GWPS	ROD RG	MCL
				37	--	--
				Exceeds	OK	OK

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

Mann-Kendall / Theil-Sen
Groundwater Trend Analysis
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

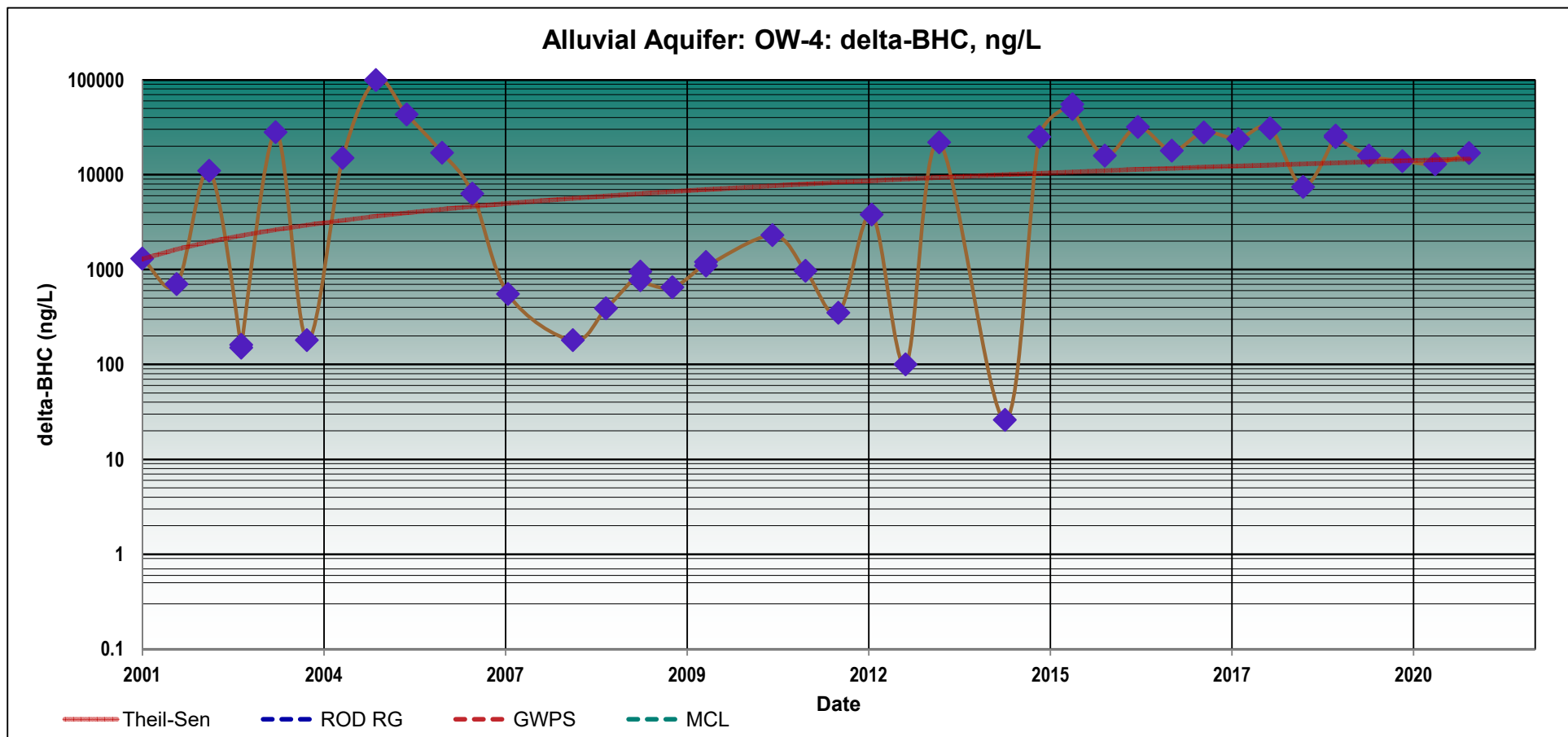
Alluvial Aquifer: M-3: delta-BHC, ng/L



No. Data Pairs = 903		Theil-Sen Slope = -0.00687 ng/L/day		Kendall S = -139		p-Value = 0.1474		Kendall Tau-b = 0.157				
	Most Recent Result (ng/L):		Not Detected		Most Recent Date:		7/8/21		Average (ng/L): 197			
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below						delta-BHC, ng/L					
	p-Value: LIKELY VALID STATISTICAL TREND (p = 0.1 to 0.2 probability from 90% to 80%)						GWPS		ROD RG		MCL	
							0		--		--	
	STABLE FOR ALL PRACTICAL PURPOSES						OK		OK		OK	
Slope insufficient to achieve the GPS in a reasonable timeframe												

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

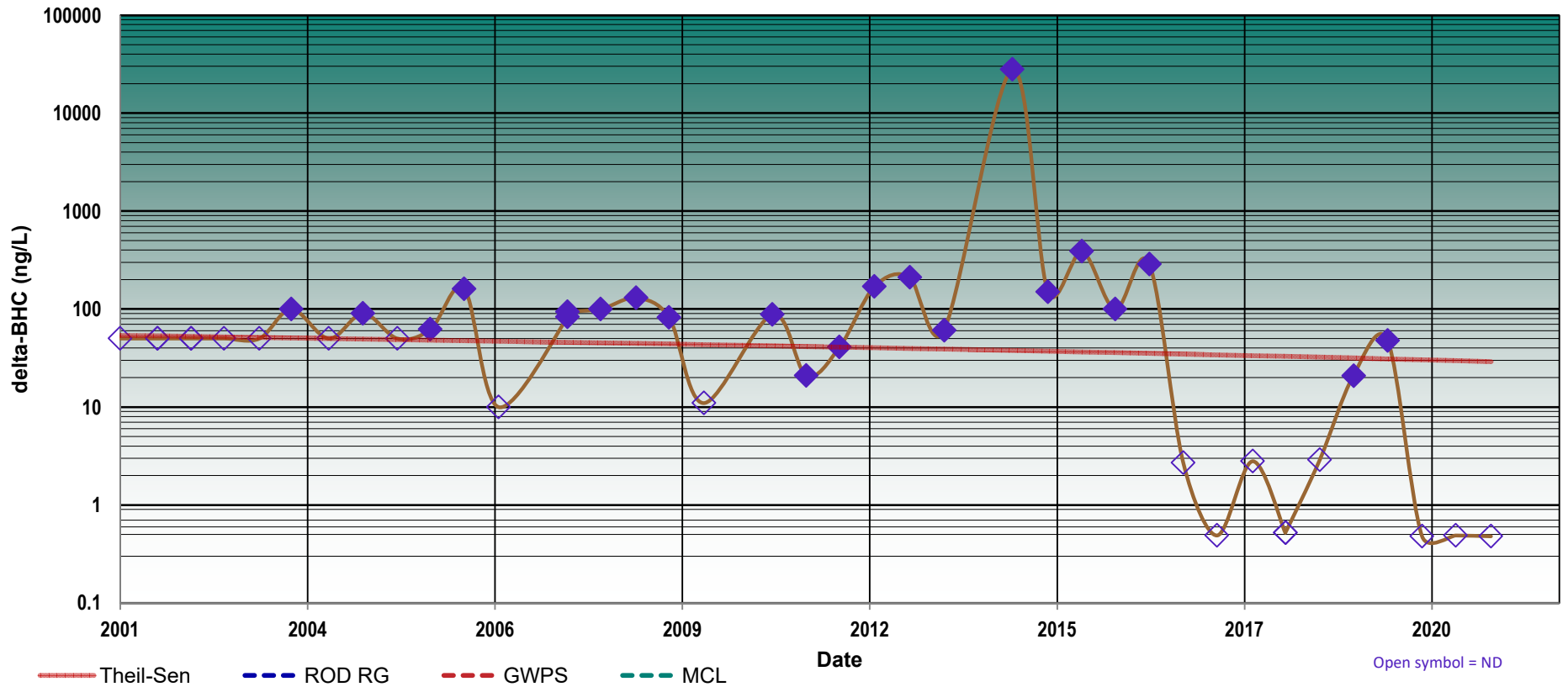


No. Data Pairs = 903	Theil-Sen Slope = 1.83113 ng/L/day	Kendall S = 231	p-Value = 0.016	Kendall Tau-b = 0.257		
	Most Recent Result (ng/L): 17000	Most Recent Date: 7/19/21		Average (ng/L): 15201		
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below			delta-BHC, ng/L		
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)			GWPS	ROD RG	MCL
				0	--	--
				Exceeds	OK	OK

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

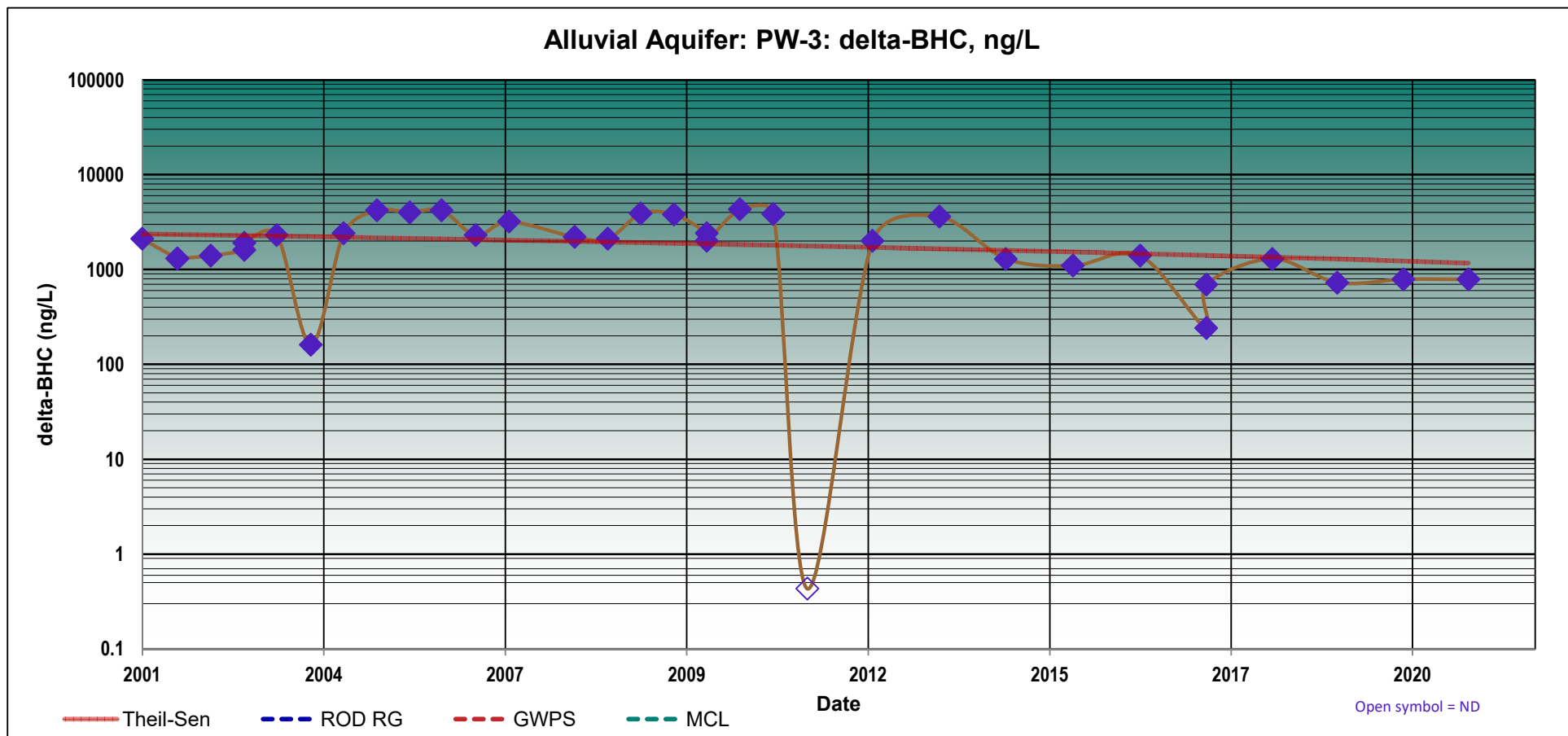
Alluvial Aquifer: OW-6: delta-BHC, ng/L



No. Data Pairs = 861		Theil-Sen Slope = -0.00338 ng/L/day		Kendall S = -151		p-Value = 0.1019		Kendall Tau-b = 0.18			
	Most Recent Result (ng/L):		Not Detected		Most Recent Date:		7/19/21		Average (ng/L): 737		
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below						delta-BHC, ng/L				
	p-Value: LIKELY VALID STATISTICAL TREND (p = 0.1 to 0.2 probability from 90% to 80%)						GWPS	ROD RG	MCL		
							0	--	--		
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe						OK	OK	OK		

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

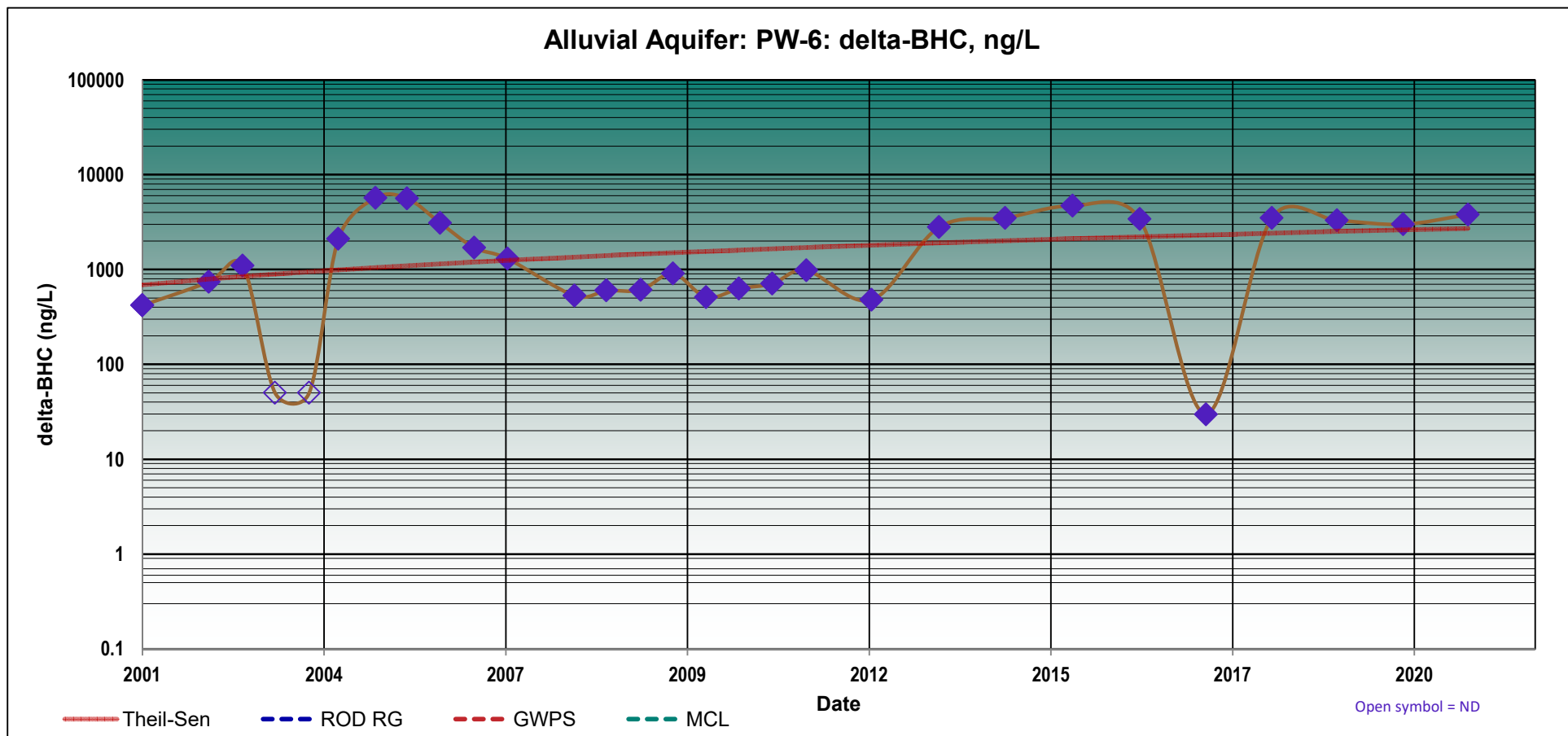
**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama



No. Data Pairs = 561	Theil-Sen Slope = -0.16459 ng/L/day	Kendall S = -113	p-Value = 0.0961	Kendall Tau-b = 0.204
	Most Recent Result (ng/L): 790	Most Recent Date: 7/15/21	Average (ng/L): 2083	
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below		delta-BHC, ng/L	
	p-Value: VALID STATISTICAL TREND (p < 0.1 probability greater than 90%)		GWPS	ROD RG
			0	--
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe		Exceeds	OK

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

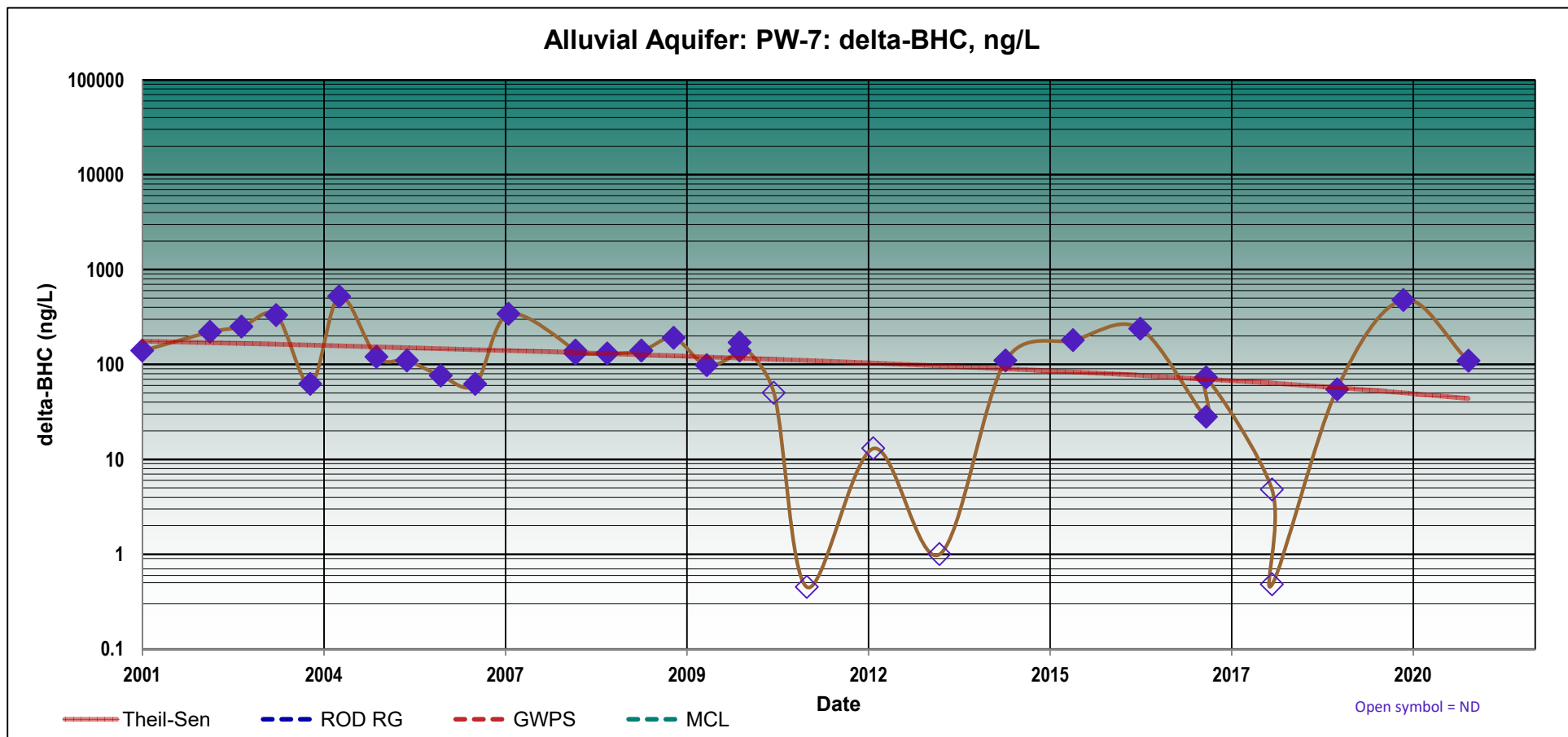
**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama



No. Data Pairs = 435	Theil-Sen Slope = 0.27798 ng/L/day	Kendall S = 112	p-Value = 0.0475	Kendall Tau-b = 0.258		
	Most Recent Result (ng/L): 3800	Most Recent Date: 7/14/21		Average (ng/L): 1876		
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below			delta-BHC, ng/L		
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)			GWPS	ROD RG	MCL
				0	--	--
				Exceeds	OK	OK

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

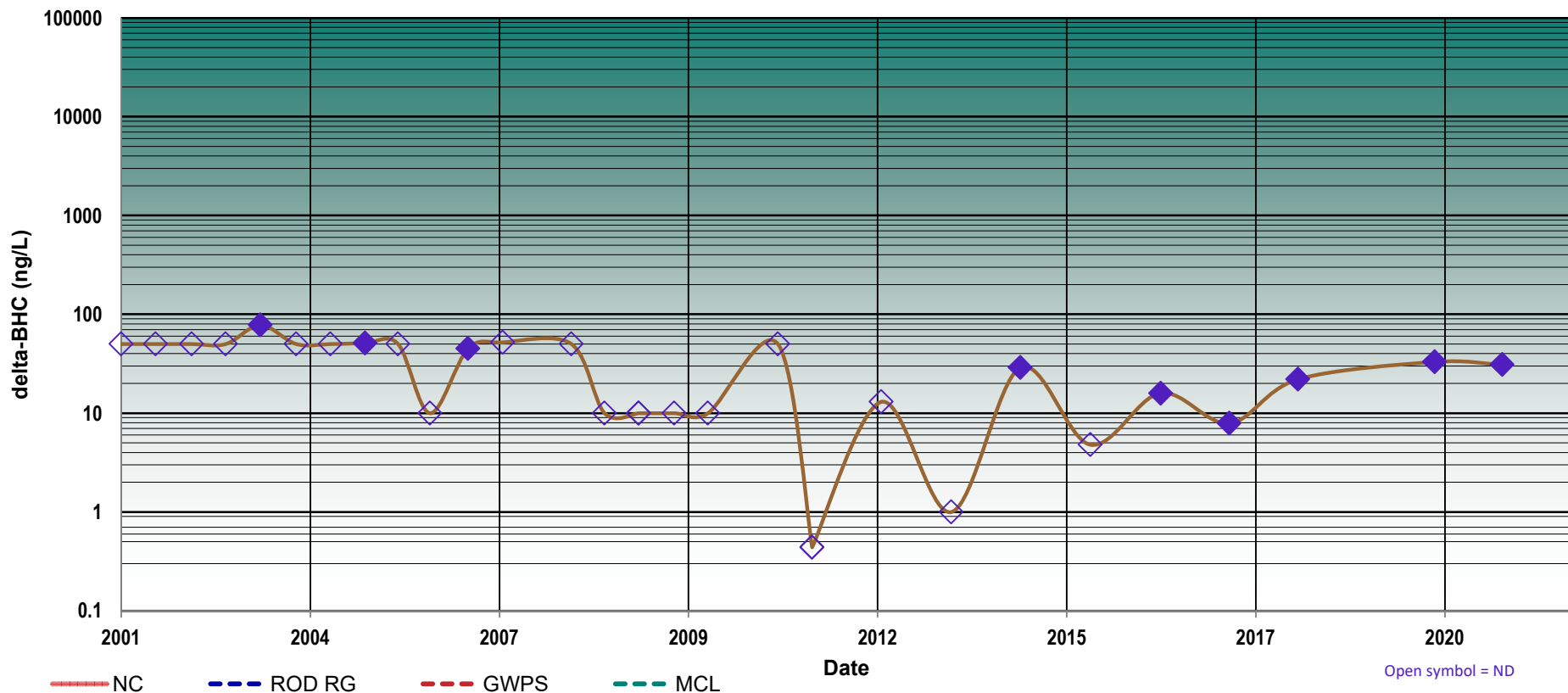


No. Data Pairs = 528	Theil-Sen Slope = -0.01816 ng/L/day	Kendall S = -137	p-Value = 0.0347	Kendall Tau-b = 0.263
	Most Recent Result (ng/L): 110	Most Recent Date: 7/15/21	Average (ng/L): 143	
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below		delta-BHC, ng/L	
	p-Value: VALID STATISTICAL TREND (p < 0.1 probability greater than 90%)		GWPS	ROD RG
			0	--
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe		Exceeds	OK

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: PW-8: delta-BHC, ng/L

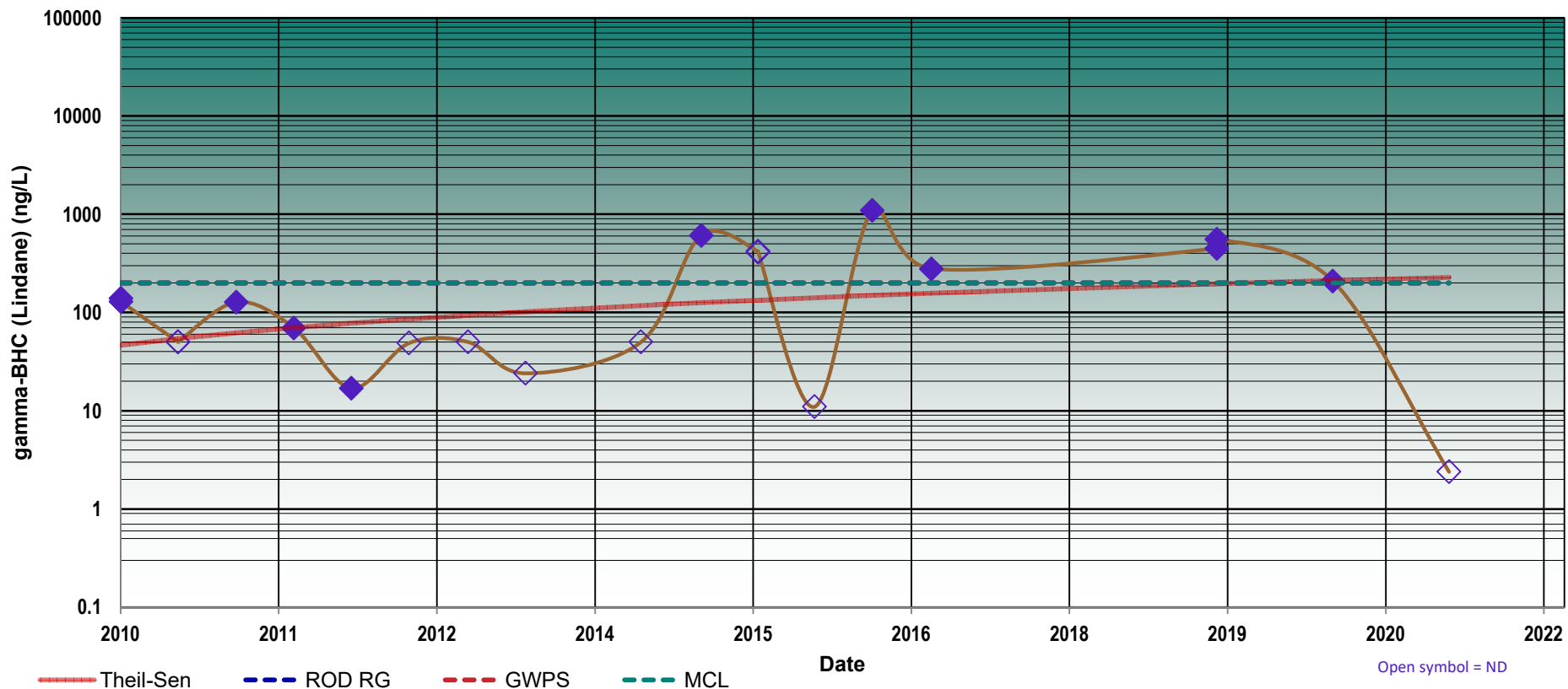


No. Data Pairs = 435	Theil-Sen Slope = NC ng/L/day	Kendall S = NC	p-Value = NC	Kendall Tau-b = NC
Most Recent Result (ng/L): 31		Most Recent Date: 7/15/21		Average (ng/L): 30
NC		delta-BHC, ng/L		
NC		GWPS	ROD RG	MCL
		0	--	--
STABLE FOR ALL PRACTICAL PURPOSES		Exceeds	OK	OK
Slope insufficient to achieve the GPS in a reasonable timeframe				
NC - Statistics not calculated, requires 50% detections				

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Alluvial Aquifer: OW-4: gamma-BHC (Lindane), ng/L



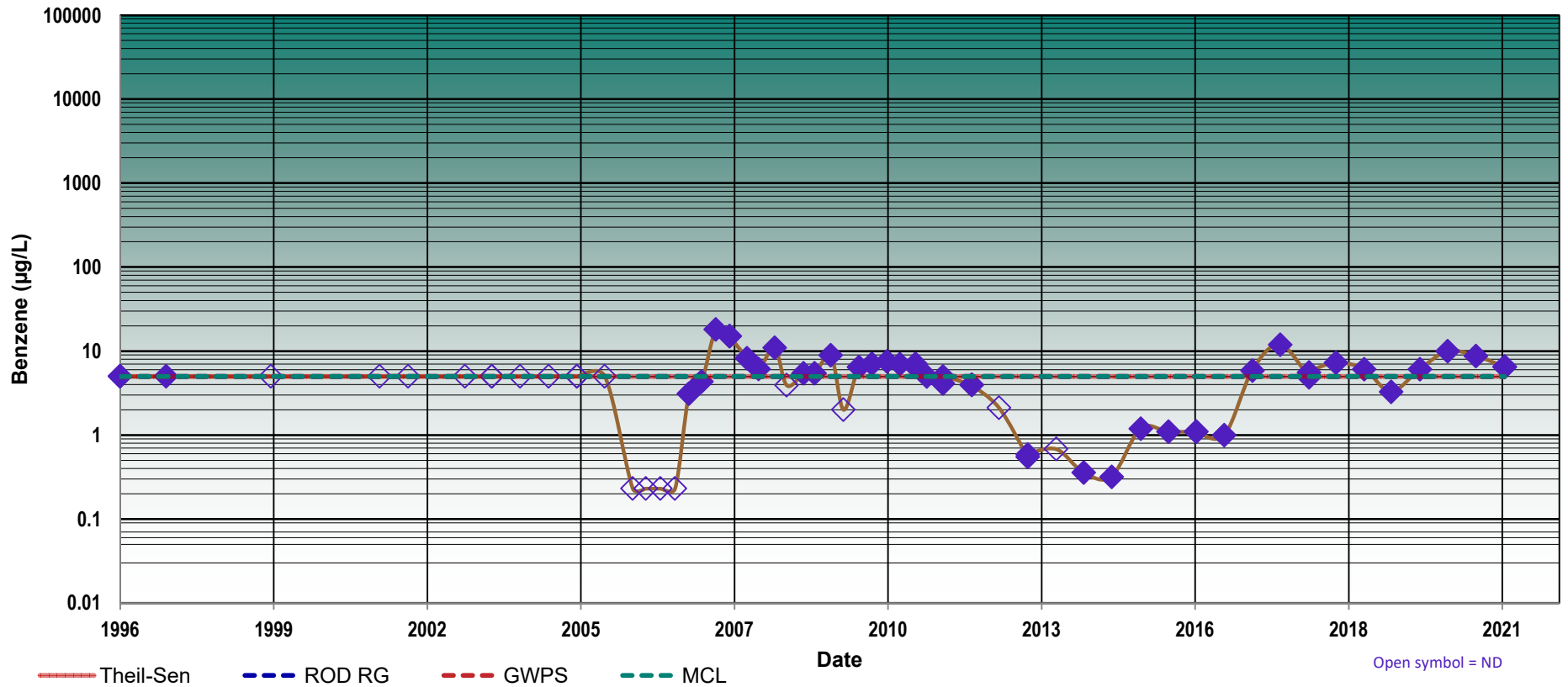
No. Data Pairs = 210	Theil-Sen Slope = 0.04323 ng/L/day	Kendall S = 25	p-Value = 0.4661	Kendall Tau-b = 0.122			
	Most Recent Result (ng/L):	Not Detected	Most Recent Date:	7/19/21	Average (ng/L):	229	
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below				gamma-BHC (Lindane), ng/L		
	p-Value: LIKELY STATISTICALLY STABLE (p = 0.2 to 0.75 low probability that the trend is valid)				GWPS	ROD RG	MCL
					200	200	200
					OK	OK	OK

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

Mann-Kendall / Theil-Sen
Groundwater Trend Analysis
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Upper Miocene Aquifer Plots

Upper Miocene: MD-2: Benzene, µg/L

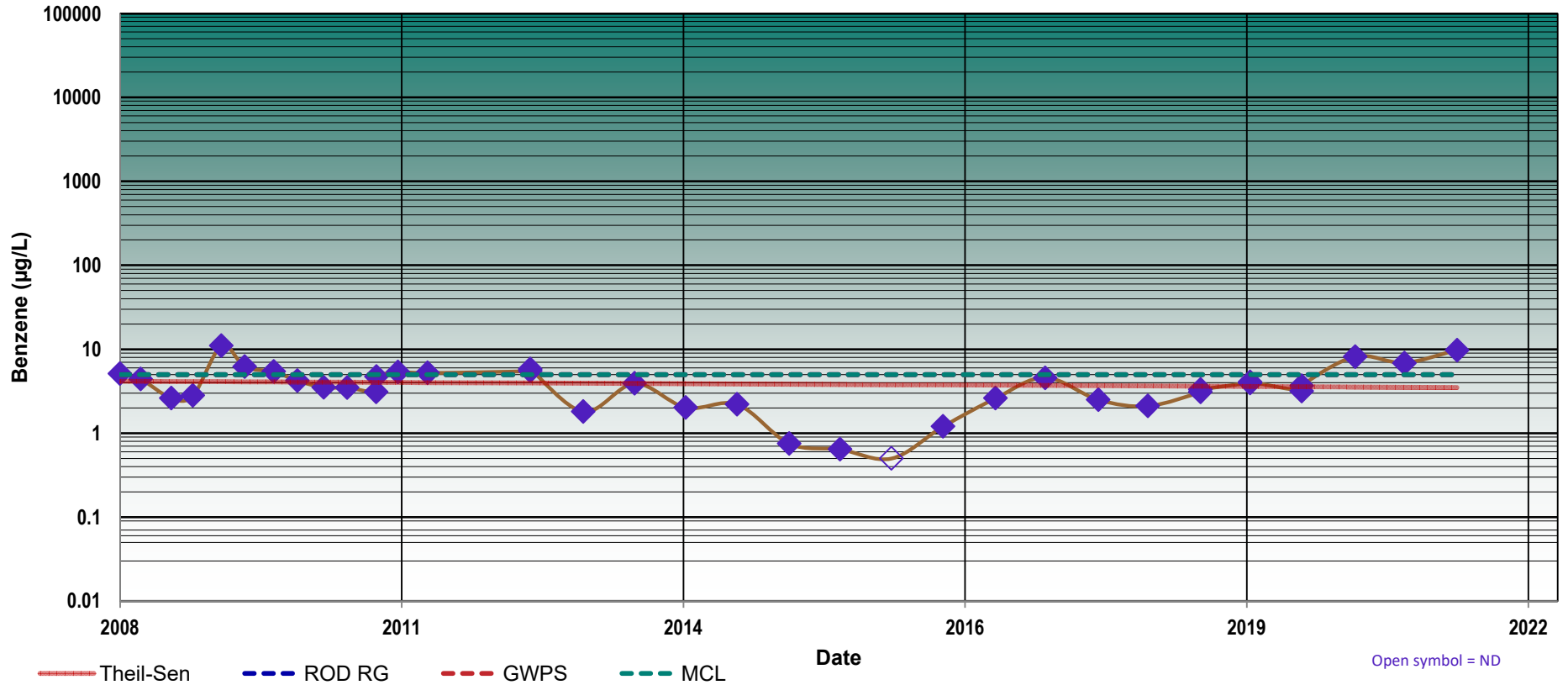


No. Data Pairs = 2080		Theil-Sen Slope = 0 µg/L/day		Kendall S = 50		p-Value = 0.78		Kendall Tau-b = 0.025	
	Most Recent Result (µg/L): 6.6			Most Recent Date: 7/26/21		Average (µg/L): 5			
	Theil-Sen and Kendall DISAGREE on trend direction, check p value below					Benzene, µg/L			
	p-Value: STATISTICALLY STABLE (p > 0.75 probability greater than 75%)					GWPS	ROD RG	MCL	
						5	5	5	
						Exceeds	Exceeds	Exceeds	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Upper Miocene: MD-12: Benzene, µg/L

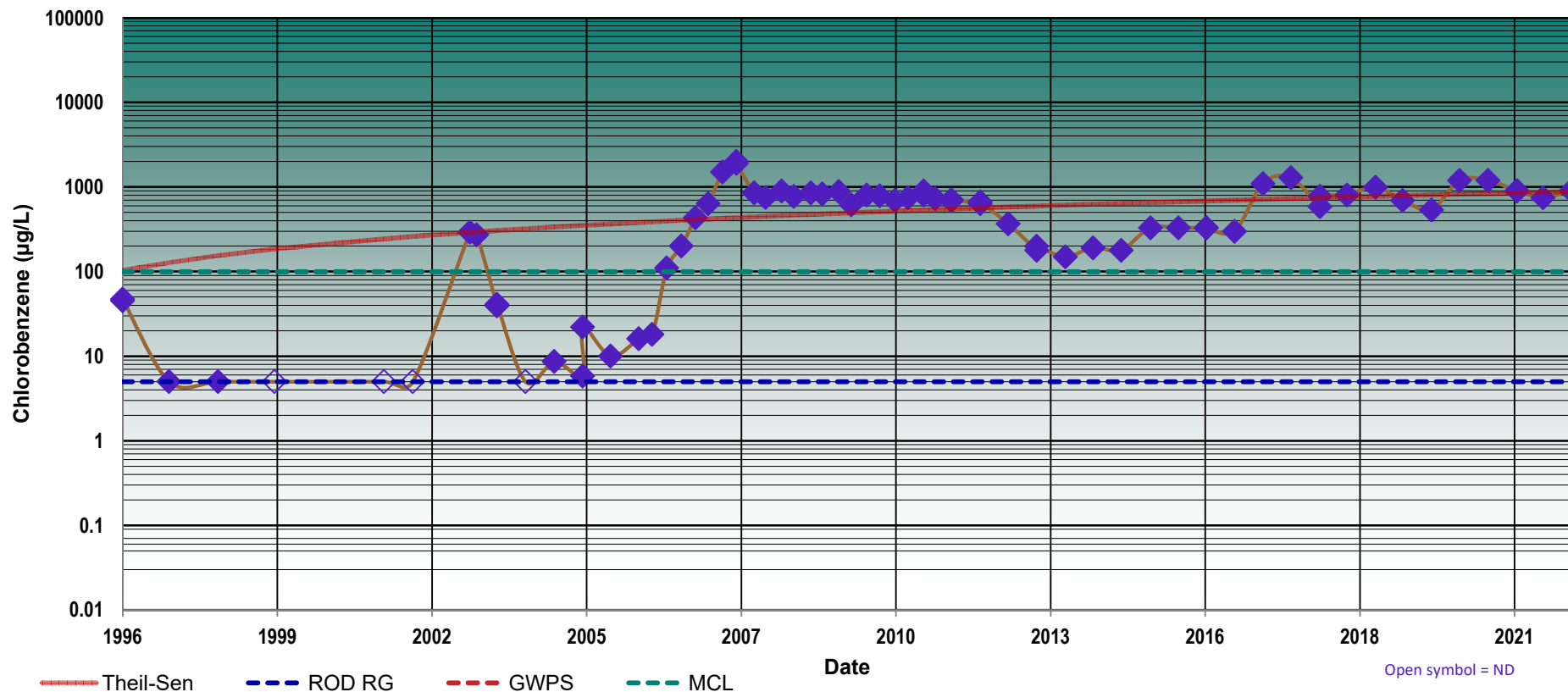


No. Data Pairs = 666		Theil-Sen Slope = -0.00013 µg/L/day		Kendall S = -38		p-Value = 0.6283		Kendall Tau-b = 0.057	
	Most Recent Result (µg/L): 9.8		Most Recent Date: 7/26/21		Average (µg/L): 4				
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below					Benzene, µg/L			
	p-Value: LIKELY STATISTICALLY STABLE (p = 0.2 to 0.75 low probability that the trend is valid)					GWPS	ROD RG	MCL	
						5	5	5	
						Exceeds	Exceeds	Exceeds	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Upper Miocene: MD-2: Chlorobenzene, µg/L

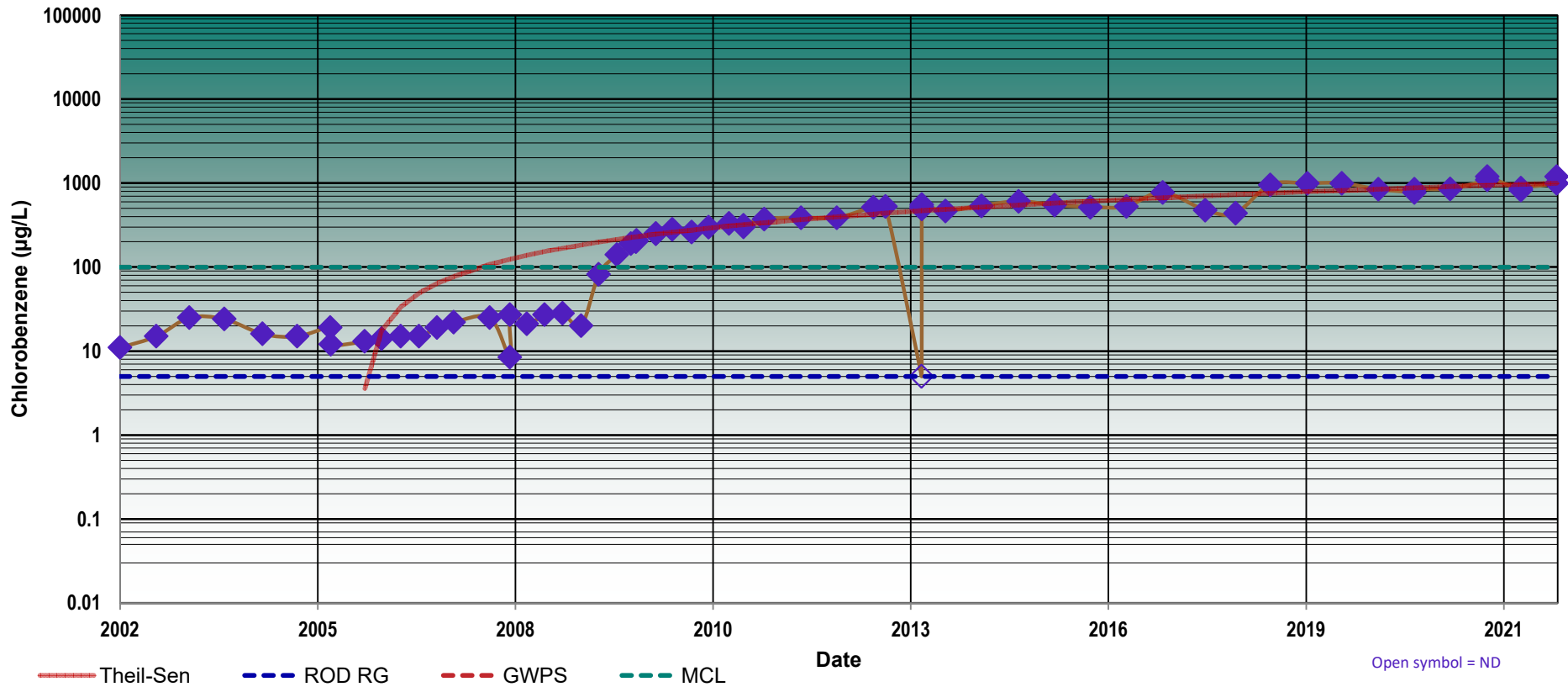


No. Data Pairs = 2346	Theil-Sen Slope = 0.08303 µg/L/day	Kendall S = 880	p-Value = 0	Kendall Tau-b = 0.378	
	Most Recent Result (µg/L): 910	Most Recent Date: 7/12/22	Average (µg/L): 549		
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below		Chlorobenzene, µg/L		
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)		GWPS	ROD RG	MCL
			100	5	100
			Exceeds	Exceeds	Exceeds

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

Mann-Kendall / Theil-Sen
Groundwater Trend Analysis
 Ciba- Geigy Corp (McIntosh Plant) OU1
 McIntosh, Alabama

Upper Miocene: MD-3B: Chlorobenzene, µg/L

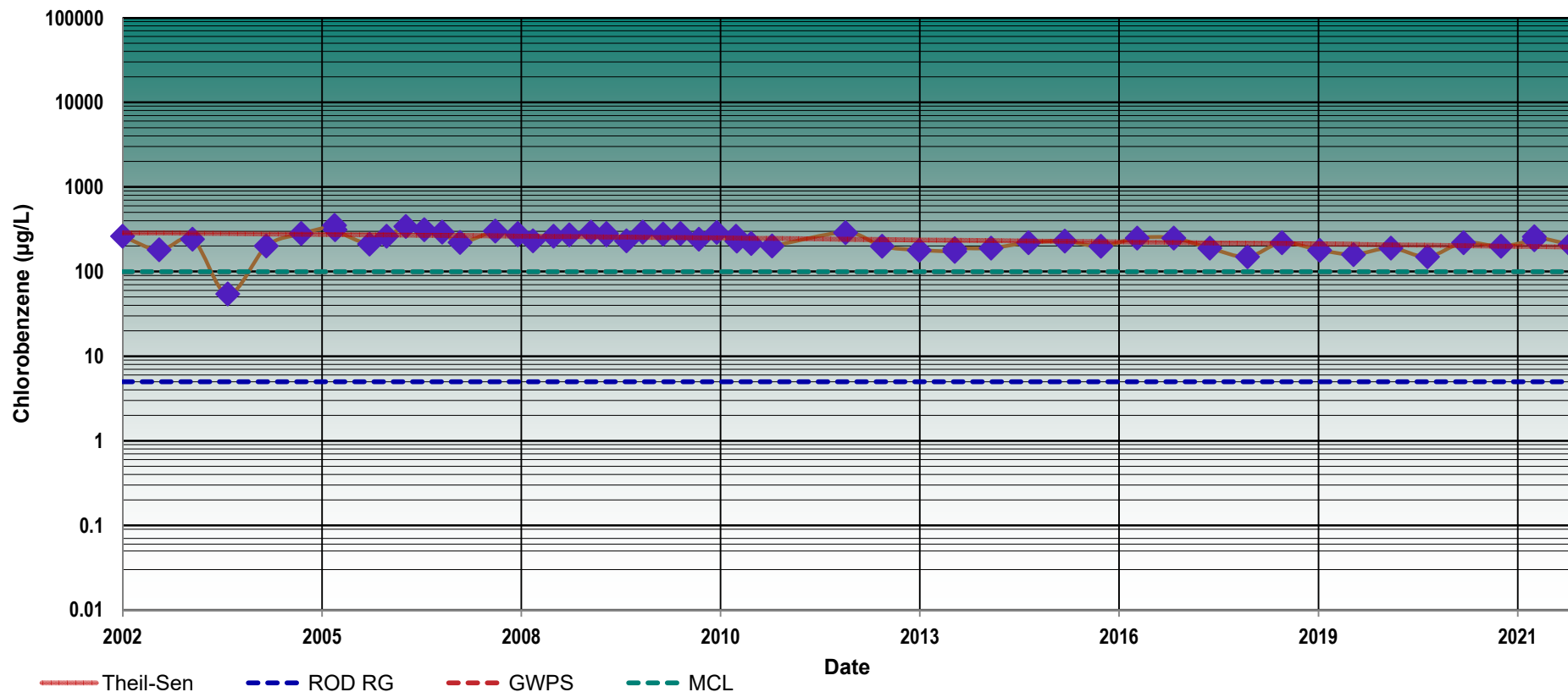


No. Data Pairs = 2278		Theil-Sen Slope = 0.16474 µg/L/day		Kendall S = 1771		p-Value = 0		Kendall Tau-b = 0.786	
	Most Recent Result (µg/L): 1200		Most Recent Date: 7/13/22		Average (µg/L): 379				
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below					Chlorobenzene, µg/L			
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)					GWPS	ROD RG	MCL	
						100	5	100	
						Exceeds	Exceeds	Exceeds	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Upper Miocene: MD-7: Chlorobenzene, µg/L

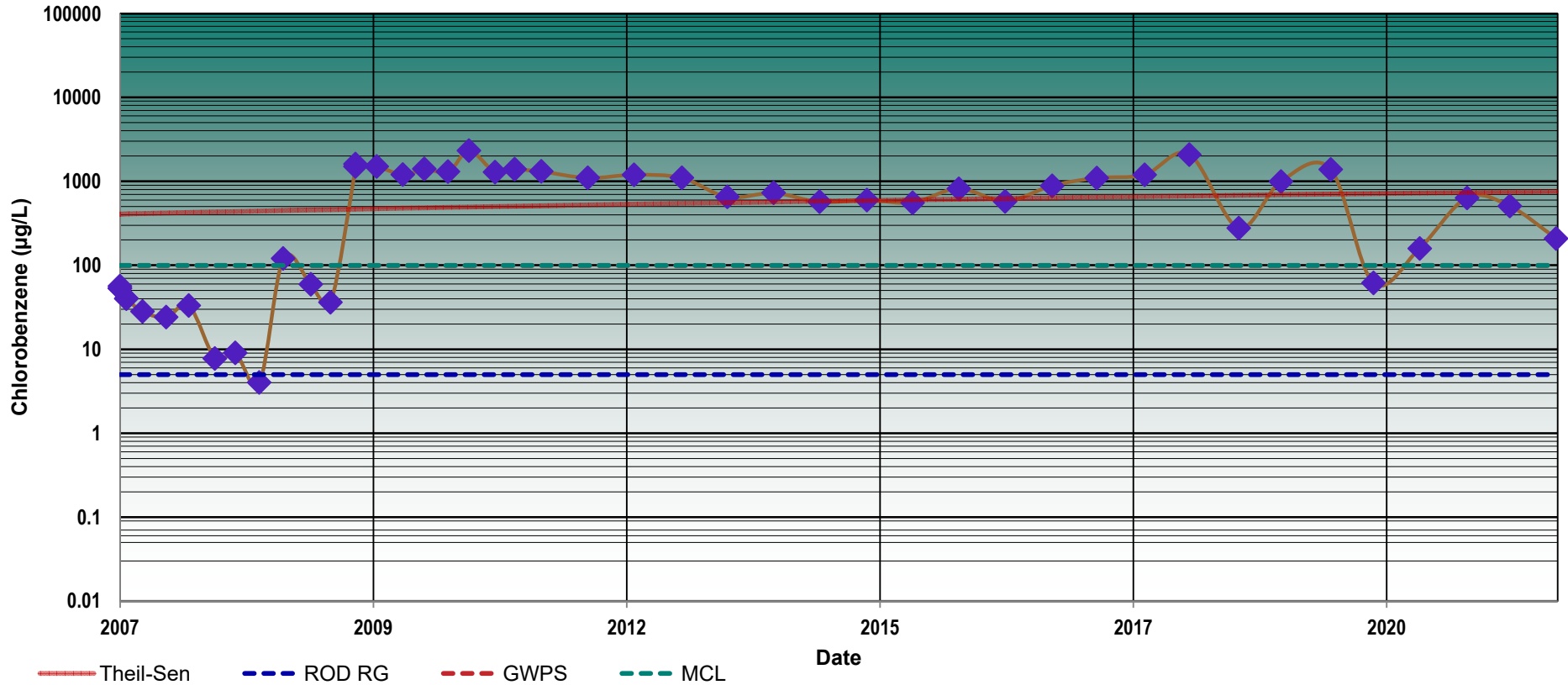


No. Data Pairs = 1540		Theil-Sen Slope = -0.01266 µg/L/day		Kendall S = -506		p-Value = 0.0003		Kendall Tau-b = 0.336	
	Most Recent Result (µg/L): 210		Most Recent Date: 7/8/22		Average (µg/L): 236				
	Theil-Sen and Kendall AGREE that trend is DECREASING, check p value below					Chlorobenzene, µg/L			
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)					GWPS	ROD RG	MCL	
						100	5	100	
	STABLE FOR ALL PRACTICAL PURPOSES Slope insufficient to achieve the GPS in a reasonable timeframe					Exceeds	Exceeds	Exceeds	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Upper Miocene: MD-11: Chlorobenzene, µg/L

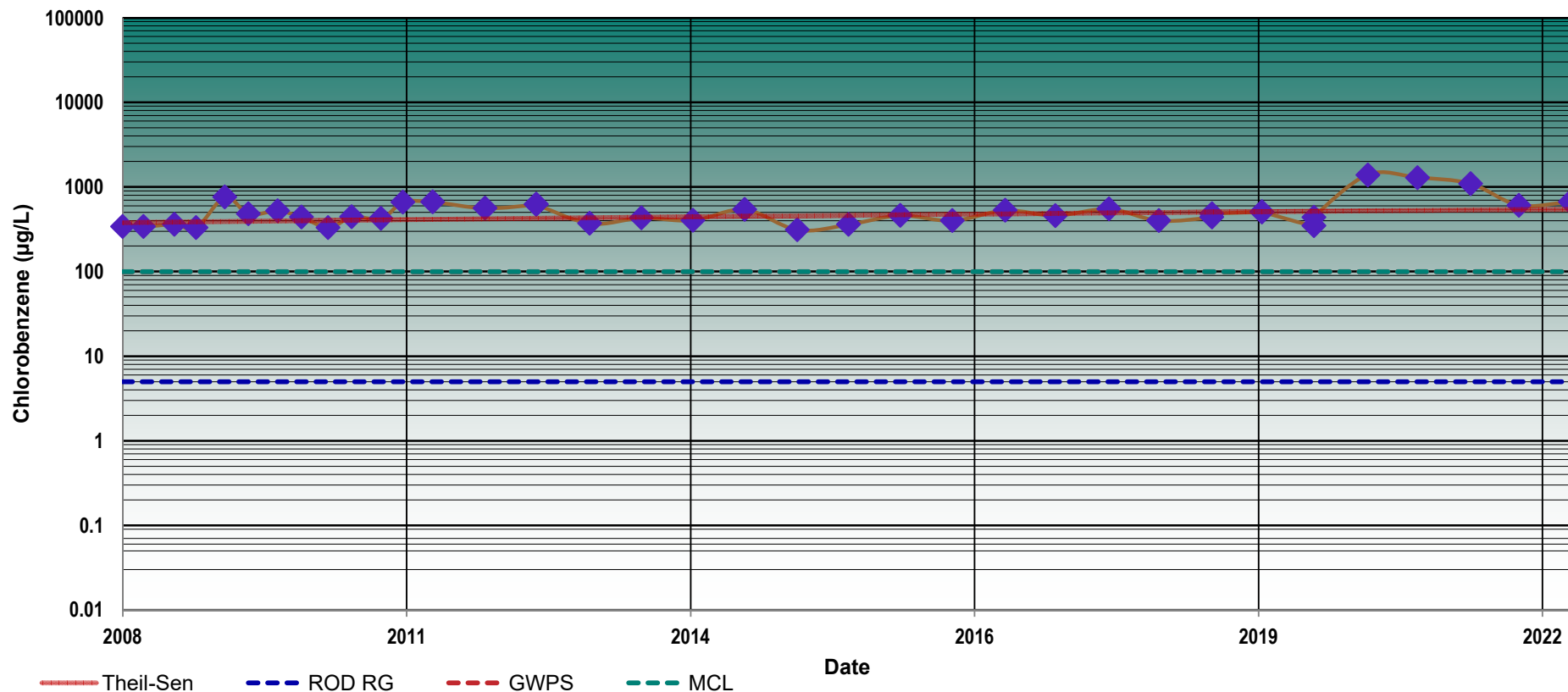


No. Data Pairs = 1035		Theil-Sen Slope = 0.06168 µg/L/day		Kendall S = 164		p-Value = 0.1225		Kendall Tau-b = 0.159		
	Most Recent Result (µg/L): 210		Most Recent Date: 7/12/22		Average (µg/L): 713					
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below					Chlorobenzene, µg/L				
	p-Value: LIKELY VALID STATISTICAL TREND (p = 0.1 to 0.2 probability from 90% to 80%)					GWPS		ROD RG		MCL
						100		5		100
						Exceeds		Exceeds		Exceeds

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Upper Miocene: MD-12: Chlorobenzene, µg/L



No. Data Pairs = 741		Theil-Sen Slope = 0.03284 µg/L/day		Kendall S = 176		p-Value = 0.0341		Kendall Tau-b = 0.24	
	Most Recent Result (µg/L): 670		Most Recent Date: 7/13/22		Average (µg/L): 536				
	Theil-Sen and Kendall AGREE that trend is INCREASING, check p value below					Chlorobenzene, µg/L			
	p-Value: VALID STATISTICAL TREND (p <0.1 probability greater than 90%)					GWPS	ROD RG	MCL	
						100	5	100	
						Exceeds	Exceeds	Exceeds	

GWPS - Groundwater Protection Standard ROD RG - Record of Decision Remedial Goal MCL - Federal Maximum Contaminant Level -- Value not established

**Mann-Kendall / Theil-Sen
Groundwater Trend Analysis**
Ciba- Geigy Corp (McIntosh Plant) OU1
McIntosh, Alabama

Attachment 2

Estimated Contaminant Distributions in Groundwater

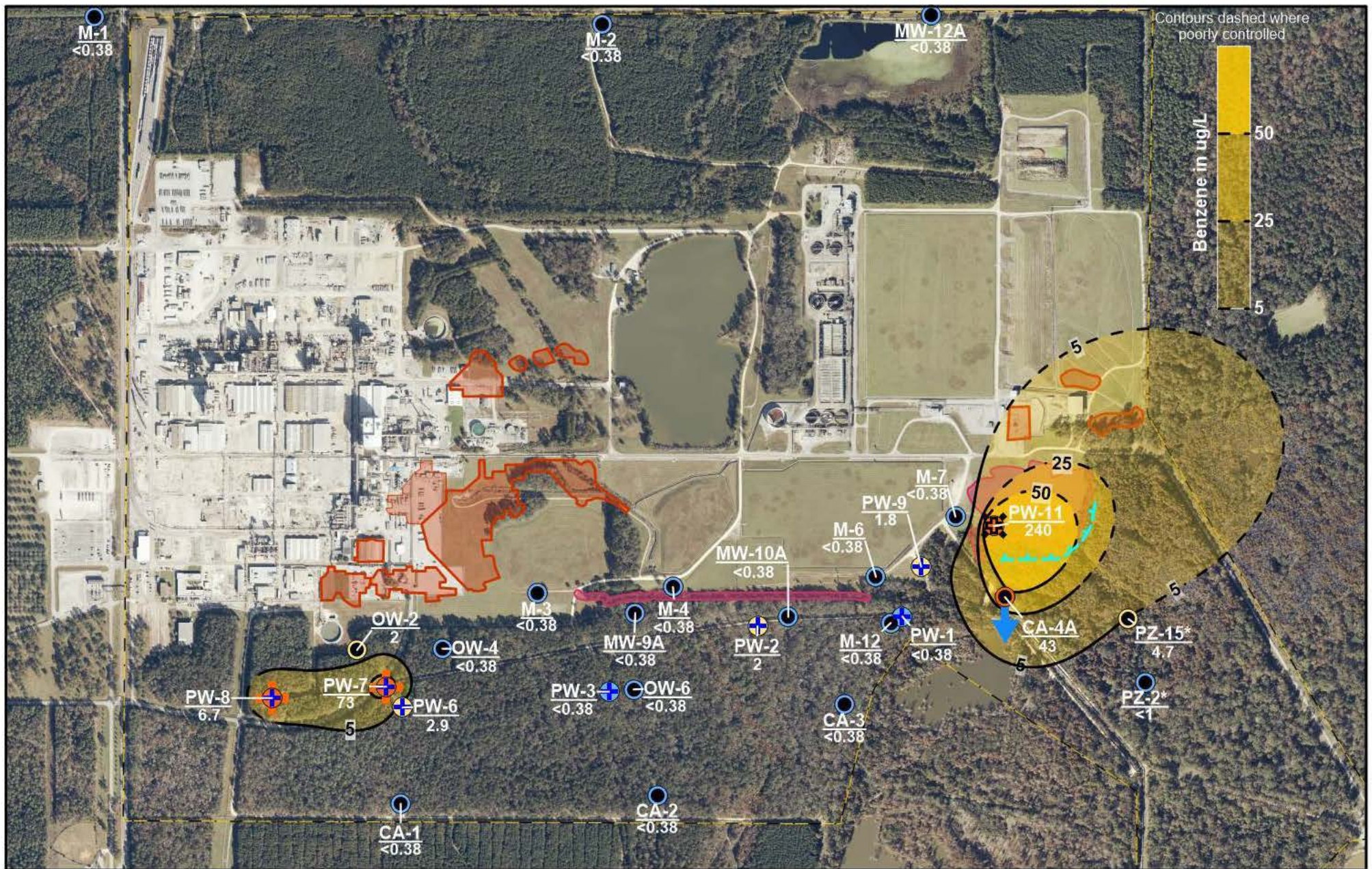
The distributions of contaminants in groundwater were estimated by EPA to provide an indication of the potential spatial coverage of exceedances of the Groundwater Protection Standards (GWPSs). The contaminants selected for these distribution analyses included the following:

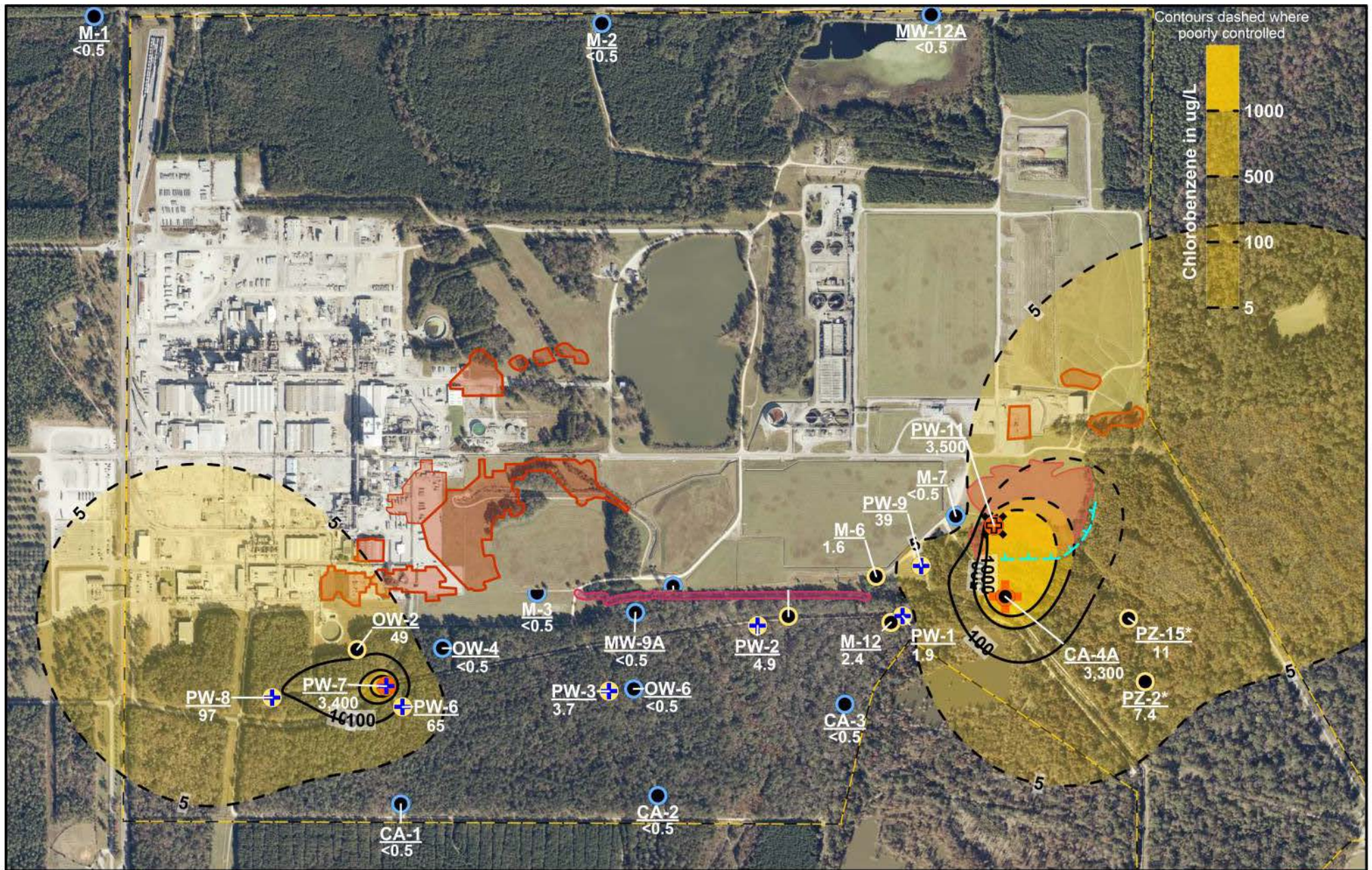
- Volatile Organic Compounds (VOCs)
 - Benzene
 - Carbon Tetrachloride
 - Chlorobenzene
- Hexachlorocyclohexanes (BHCs)
 - a-BHC
 - b-BHC
 - d-BHC
 - g-BHC (Lindane)
- Organochlorine Insecticides
 - 4,4'-DDD (p,p'-DDD)
 - 4,4'-DDE (p,p'-DDE)
 - 4,4'-DDT (p,p'-DDT)

These contaminants include those having some of the highest frequencies of exceeding the GWPSs. The contaminant concentrations used for these analyses are the highest concentrations detected in the current database or provided in the Comprehensive Annual Reports from 2020, 2021, and 2022. For locations that did not have a detection, the lowest detection limit reported was used as the concentration. “J” estimated values were at the estimated concentration. A total of 27 wells were included for the alluvial aquifer and 18 wells were included for the Upper Miocene aquifer.

The distribution estimates were made using Surfer® 23.4.238, July 30, 2022. Surfer® was used to prepare regular grid files from the irregularly spaced data points using the “Kriging” method with the log value of the concentration used for gridding. The X and Y domain of the grid area was specified to provide sufficient coverage. The grid spacing was set at 5 feet. All other data handling options were set to the Surfer® default values.

Alluvial Aquifer Contaminant Distributions





Record of Decision Remedial Goal = 5 ug/L
 Federal Maximum Contaminant Level not established
 Groundwater Protection Standard = 100 ug/L
 Posted values are chlorobenzene in ug/L

Scale in Feet
 0 500 1,000 1,500 2,000

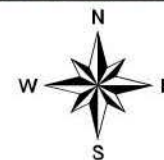
● Alluvium Monitoring Well
 + Active Alluvium Extraction Well
 ⊕ Inactive Alluvium Extraction Well

● Not Detected
 ● Detected Below GWPS
 ● Exceeds GWPS

Exceedance Location Trends

Decreasing
 Stable
 Increasing
 Not Calculated

Trends not calculated for locations with too few samples or less than 50 percent detections

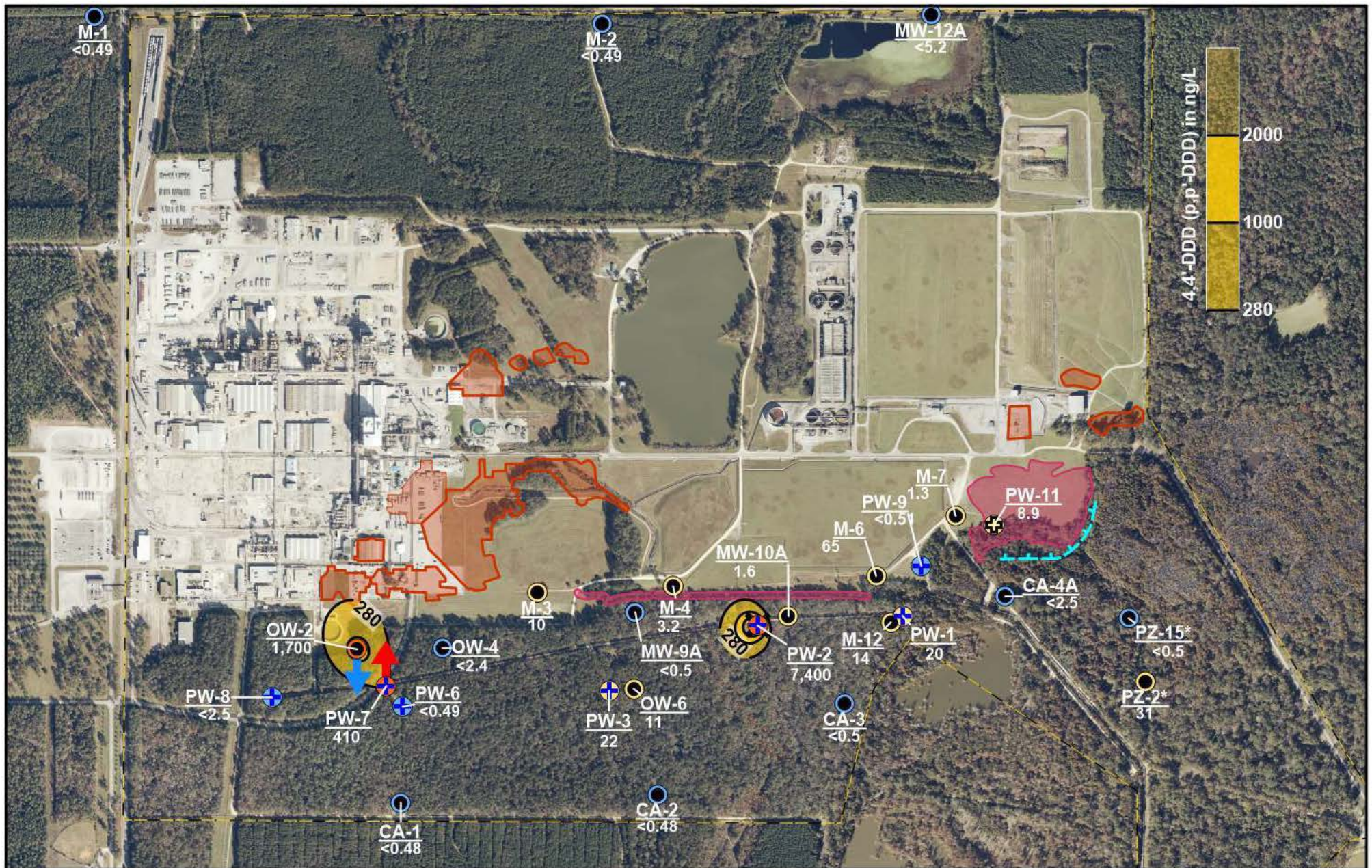


OU2

OU4

Alluvial Aquifer Chlorobenzene

Ciba-Geigy Corp (McIntosh Plant)
 McIntosh, Alabama



Record of Decision Remedial Goal & Federal Maximum Contaminant Level not established
 Groundwater Protection Standard = 280 ng/L
 Posted values are 4,4'-DDD (p,p'-DDD) in ng/L

- Alluvium Monitoring Well
- + Active Alluvium Extraction Well
- ⊕ Inactive Alluvium Extraction Well

- Not Detected
- Detected Below GWPS
- Exceeds GWPS

Exceedance Location Trends

- Decreasing (Blue arrow pointing down)
- Stable (Orange plus sign)
- Increasing (Red arrow pointing up)
- Not Calculated (Black X)

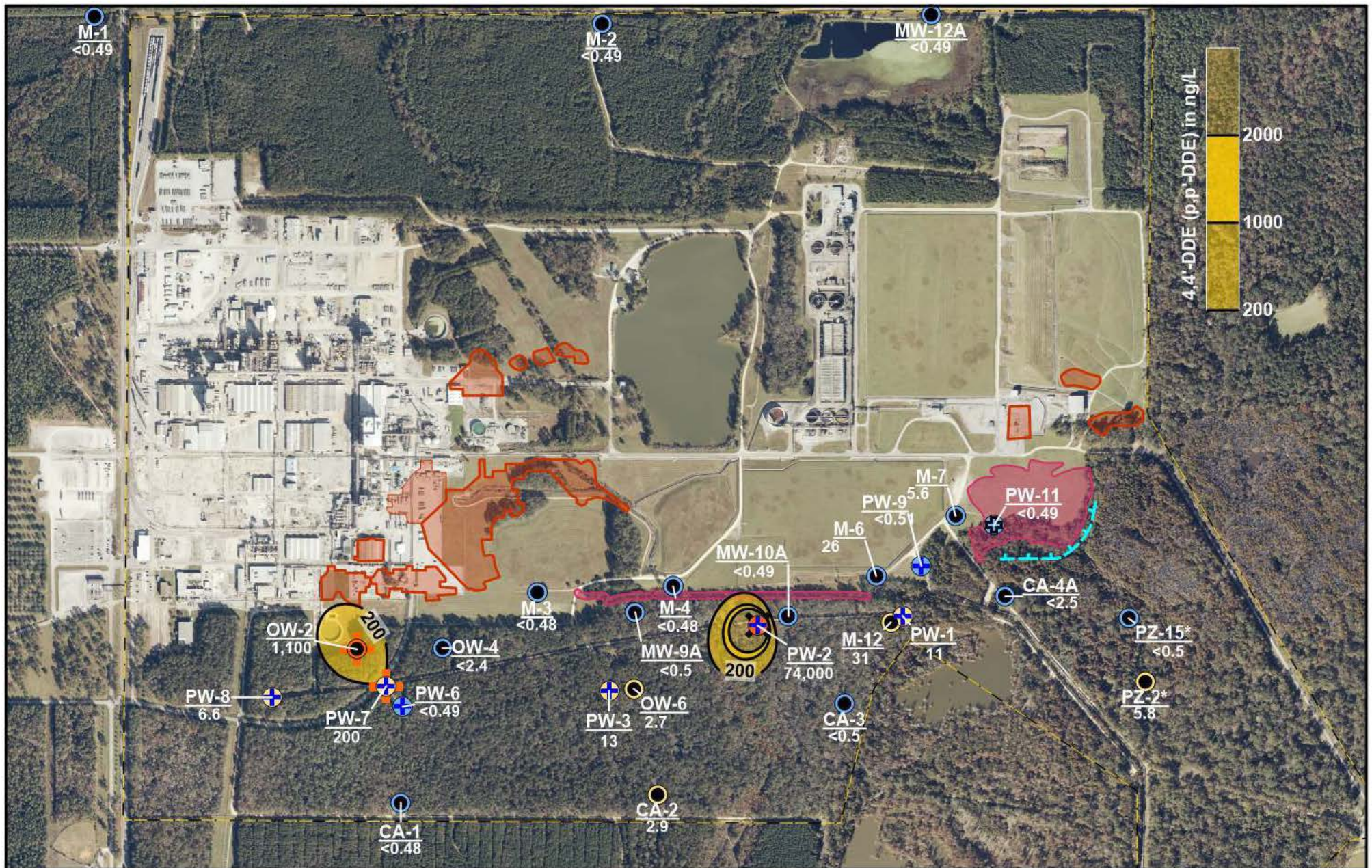
Trends not calculated for locations with too few samples or less than 50 percent detections



OU2

OU4

Alluvial Aquifer
4,4'-DDD (p,p'-DDD)
 Ciba-Geigy Corp (McIntosh Plant)
 McIntosh, Alabama



Record of Decision Remedial Goal & Federal Maximum Contaminant Level not established
Groundwater Protection Standard = 200 ng/L
Posted values are 4,4'-DDE (p,p'-DDE) in ng/L

- Alluvium Monitoring Well
- + Active Alluvium Extraction Well
- ⊕ Inactive Alluvium Extraction Well
- Not Detected
- Detected Below GWPS
- Exceeds GWPS

Exceedance Location Trends

- Decreasing (Blue arrow pointing down)
- Stable (Orange plus sign)
- Increasing (Red arrow pointing up)
- Not Calculated (Black X)

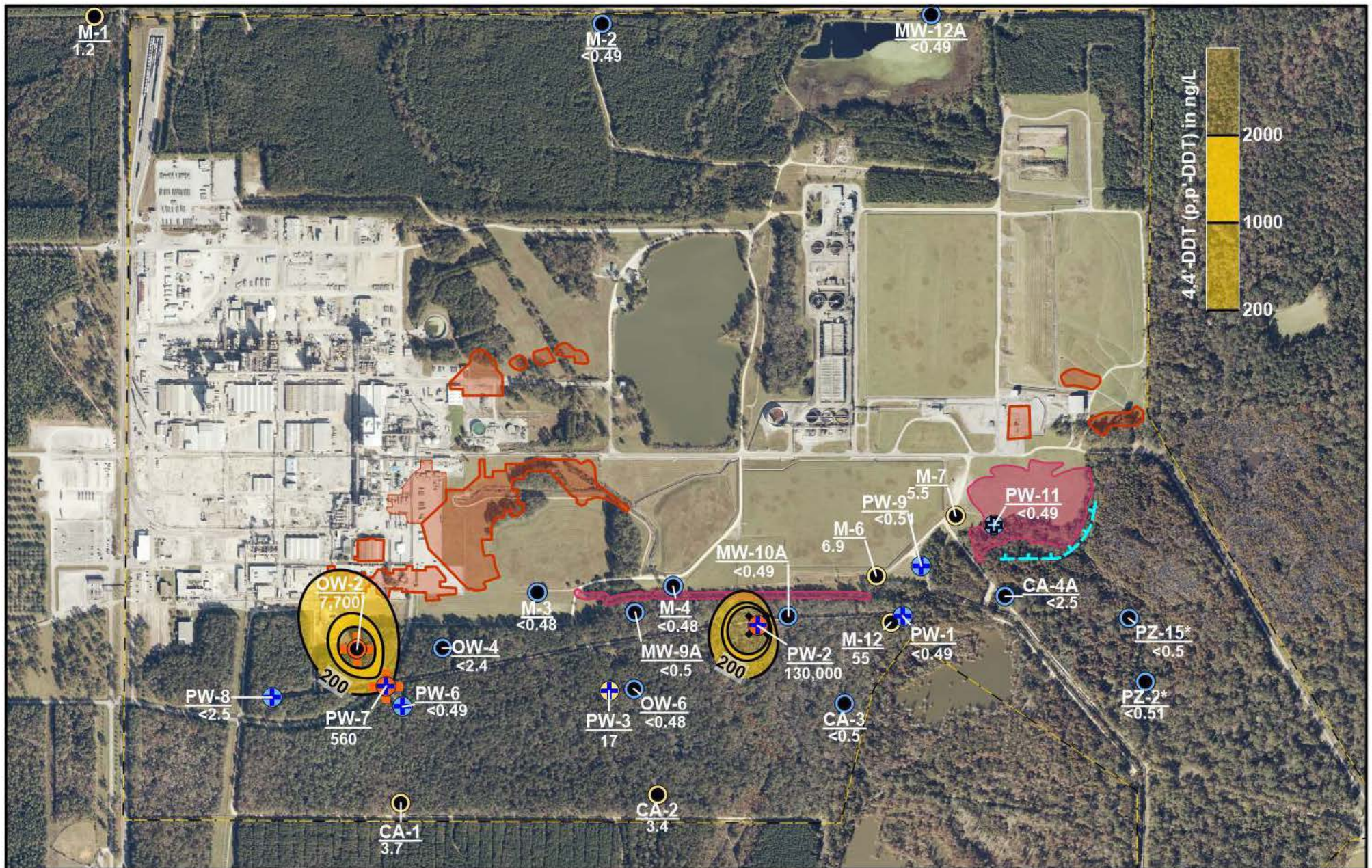
Trends not calculated for locations with too few samples or less than 50 percent detections



OU2

OU4

Alluvial Aquifer
4,4'-DDE (p,p'-DDE)
Ciba-Geigy Corp (McIntosh Plant)
McIntosh, Alabama



Exceedance Location Trends

Decreasing

Stable

Increasing

Not Calculated

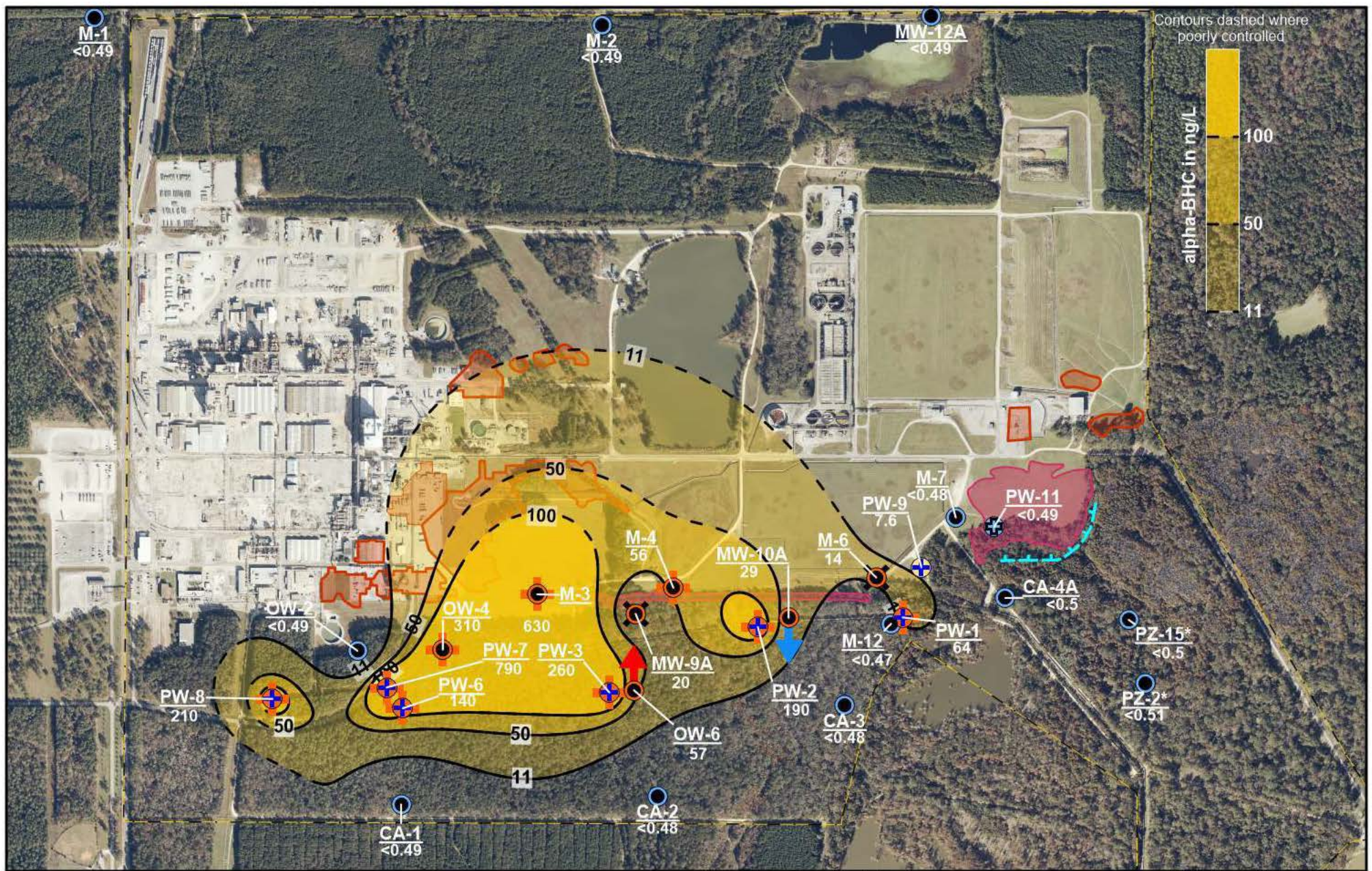
Trends not calculated for locations with too few samples or less than 50 percent detections



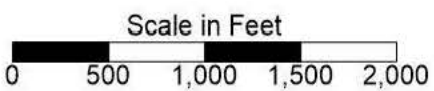
OU2

OU4

Alluvial Aquifer
4,4'-DDT (p,p'-DDT)
Ciba-Geigy Corp (McIntosh Plant)
McIntosh, Alabama

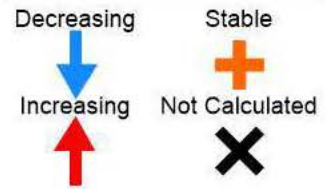


Record of Decision Remedial Goal = 50 ug/L
 Federal Maximum Contaminant Level not established
 Groundwater Protection Standard = 11 ng/L
 Posted values are alpha-BHC in ng/L



- Alluvium Monitoring Well
- + Active Alluvium Extraction Well
- ⊕ Inactive Alluvium Extraction Well
- Not Detected
- Detected Below GWPS
- Exceeds GWPS

Exceedance Location Trends



Trends not calculated for locations with too few samples or less than 50 percent detections

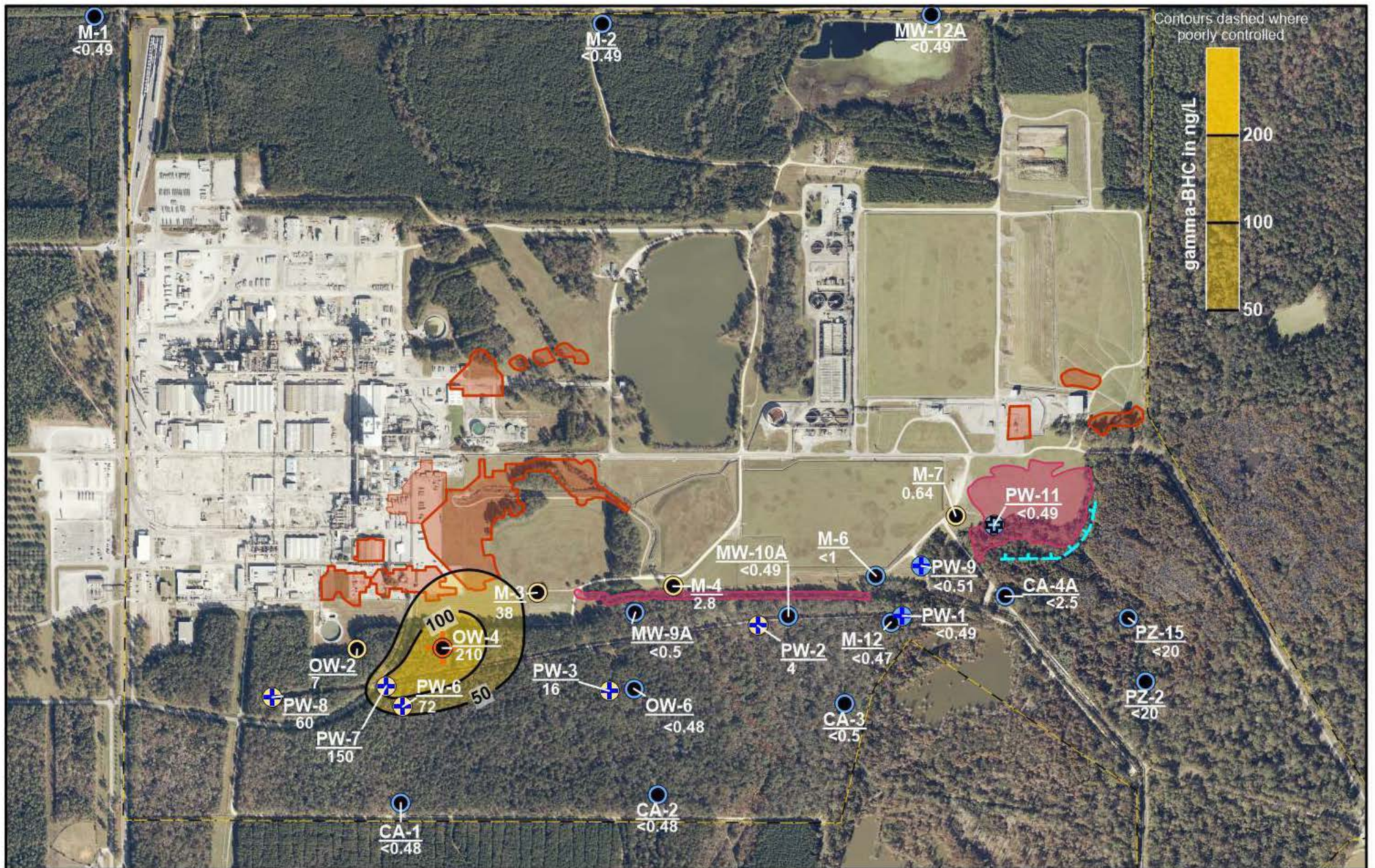


BHC - Hexachlorocyclohexane



**Alluvial Aquifer
alpha-BHC**

Ciba-Geigy Corp (McIntosh Plant)
 McIntosh, Alabama



Record of Decision Remedial Goal,
Federal Maximum Contaminant Level, &
Groundwater Protection Standard = 200 ng/L
Posted values are gamma-BHC in ng/L

Scale in Feet
0 500 1,000 1,500 2,000

- Alluvium Monitoring Well
- + Active Alluvium Extraction Well
- ⊕ Inactive Alluvium Extraction Well

- Not Detected
- Detected Below GWPS
- Exceeds GWPS

Exceedance Location Trends

- Decreasing (Blue arrow pointing down)
- Stable (Orange plus sign)
- Increasing (Red arrow pointing up)
- Not Calculated (Black X)

Trends not calculated for locations with too few samples or less than 50 percent detections



BHC - Hexachlorocyclohexane

OU2

OU4

**Alluvial Aquifer
gamma-BHC (Lindane)**
Ciba-Geigy Corp (McIntosh Plant)
McIntosh, Alabama

Upper Miocene Aquifer Contaminant Distributions

